University of Pune

Ganeshkhind, Pune – 411 007

Ph. D. Entrance Test

Question Paper-II Format and Syllabus

Instruction

All candidates appearing for the Ph.D. Entrance Test (Paper-II) should contact to the concern respective University departments regarding time, date and more information about Ph.D. Entrance Test (Paper-II).

Department of English

Ph. D. Entrance Test

Question Paper Format and Syllabus

Part One

English Language and Literature and Related Areas

Question One

Objective / Multiple Choice Questions 20 Marks

Syllabus for Part One, Question One :

1. British Literature from 14th to 20th Century
2. Indian Literature in English
3. English Linguistics

Question Two

Two (2) small essay-type questions, 15 marks each 30 Marks

Syllabus for Part One, Question Two

1. British Literature from 14th to 20th Century
2. Indian Literature in English
3. English Linguistics
4. European Literature from 18th to 20th Century
5. Non-British English Literatures (e.g. African, South Asian, American, Latin American etc.)
6. Stylistics
7. Pragmatics
8. Culture Studies
9. Film Studies
10. Semiotics / Semiology

Part Two

One long essay on your topic of research 50 Marks

The essay should be written with the help of guiding questions that will be provided to you. Below is a sample of such guiding questions

a] Why have you chosen this particular topic?
b] What theories and methods do you plan to use?
c] How familiar are you with existing material on this topic? Illustrate.
d] What do you expect to prove or disprove in your research?
e] What is your yearly plan of research?

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पीएच.डी. प्रवेश पूर्व परीक्षा
प्रश्नपत्र स्वरूप तथा अंक विभाजन

दिनांक २३/१०/२००९

हिंदी पाठ्यक्रम :

(समय : तीन घंटे)
(कुल अंक : १००)

सूचना : प्रश्न क्रमांक ५ और ६ अनिवार्य हैं।

प्रश्न	१.	दीर्घोत्तरी प्रश्न अथवा दीर्घोत्तरी प्रश्न	} १६
प्रश्न	२.	दीर्घोत्तरी प्रश्न अथवा दीर्घोत्तरी प्रश्न	} १६
प्रश्न	३.	दीर्घोत्तरी प्रश्न अथवा लघुत्तरी प्रश्न (६ में से ४)	} १६
प्रश्न	४.	दीर्घोत्तरी प्रश्न अथवा टिप्पणियाँ (६ में से ४)	} १६
प्रश्न	५.	ससंदर्भ व्याख्या अ अथवा अ ब अथवा ब	} १६
प्रश्न	६.	वस्तुनिष्ठ प्रश्न (२० में से २०)	} २०

पीएच. डी. प्रवेशपूर्व परीक्षा
हिंदी पाठ्यक्रम

इकाई – I अनुसंधान पध्दति एवं प्रविधि।

- अनुसंधान की परिभाषा, अनुसंधान के लिए प्रयुक्त शब्द, अनुसंधान का उद्देश्य ।
- अनुसंधाता और शोध–मार्गदर्शक का व्यक्तित्व
- अनुसंधान की व्याप्ति, सीमा, अनुसंधान के विविध क्षेत्र।
- साहित्य, भाषा, साहित्य का इतिहास के अनुसंधान का स्वरूप, विशेषताएँ।
- अनुसंधान और आलोचना, उपाधिसापेक्ष और उपाधिनिरपेक्ष अनुसंधान।
- अनुसंधान के प्रकार एवं पध्दतियाँ।
- साहित्यनुसंधान में अन्य विद्याशखाओं का अनुप्रयोग–समाजशास्त्र, मनोविज्ञान, इतिहास, नृतत्व शास्त्र, सौंदर्यशास्त्र, भाषाविज्ञान, शैलीविज्ञाान, दर्शन।
- तुलनात्मक अनुसंधान का स्वरूप, प्रकार, उपलब्धियाँ।
- अनुसंधान–प्रविधि :– विषय–निर्वाचन, प्राक्कल्पना, शोध–विषय की रूपरेखा, शोध–पध्दति का निर्वाह, सामग्री संकलन, सामग्री विश्लेषण–विवेचन–वर्गीकरण, विषयानुक्रम, भूमिका, अध्याय–विभाजन, पादटिप्पण, संदर्भ–चयन और प्रस्तुति शोध–प्रबंध की भाषा, निष्कर्ष–प्रस्तुति, उपसंहार, परिशिष्ट आदि।
- शोध–कार्य तथा शोध–प्रबंध लेखन में आनेवाली कठिनाइयाँ, दोषों की संभावना, शोध–कार्य की गुणात्मकता।
- साहित्यानुसंधान के विविध साधन–मुद्रित, तकनीकी, यांत्रिक साधन।
- अनुसंधान की नई दिशाएँ, नये क्षेत्र, नई चुनौतियाँ।

इकाई –II हिंदी की अध्यापन पध्दति।

- स्नातक एवं स्नातकोत्तर स्तर पर हिंदी के अध्ययन–अध्यापन का स्वरूप, उद्देश्य, उपलब्धियाँ।
- हिंदी की गद्य–विधाओं का अध्यापन :– मूलभूत विशेषताएँ।
- हिंदी की पद्य–विधाओं का अध्यापन :– मूलभूत विशेषताएँ।
- साहित्य के अध्यापन में रचना पक्ष, भाषा, ौली का विश्लेषण।
- साहित्य के अध्यापन में साहित्य की अंतर्वस्तु का विश्लेषण।
- साहित्य के अध्यापन में अन्य विद्या शाखाओं का संदर्भ, ज्ञान।
- साहित्य के अध्यापक की योग्यताएँ/व्यक्तित्व।
- साहित्य के अध्यापन में तकनीकी साधनों की सहायता।
- मीडिया और हिंदी साहित्य।
- अध्यापन के सूत्र।

इकाई –III प्राचीन एवं मध्ययुगीन हिंदी साहित्य।

- हिंदी भाषा के प्राचीन रूप – पालि, प्राकृत, अपभ्रंश, अवहट्ट, डिंगल–पिंगल।
- हिंदी की बोलियाँ, उपबोलियाँ, बोलियों में विरचित साहित्य।
- आदिकालीन जैन, सिद्ध, नाथ साहित्य, रासो साहित्य, अमीर खुसरों एवं विद्यापति का साहित्य।
- भक्तिकालीन साहित्य की प्रेरणाएँ प्रभाव, भक्तिधाराएँ।
- कबीर – कबीर के राम, कबीर का समाज दर्शन बीर : कवि के रूप में, कबीर के काव्य की प्रासेगिकता।
- जायसी – पद्मावत का प्रबंधत्व, पद्मावत में सौंदर्य–चित्रण, संस्कृति–चित्रण, पद्मावत में दार्शनिकता।

- सूरदास – भक्ति–भावना, सूरदास के काव्य का भावनापक्ष, सूरदास की वाग्विदग्धता, सूरदास के काव्य का सौंदर्य बोध।
- तुलसीदास – भक्ति, दर्शन, तुलसी का लोकमंगलत्व, तुलसीदास की काव्य–दृष्टि।
- भक्तिकाल के साहित्य का सामाजिक, सांस्कृतिक, साहित्यिक प्रदेय।
- रीतिकाल की सामाजिक– सांस्कृतिक दृष्टि, राजनीतिक पृष्ठभूमि, रीतिकालीन साहित्य की प्रमुख प्रवृत्तियाँ।
- रीतिकाल का हिंदी काव्यशास्त्र, केशव और पद्माकर का आचार्यत्व ।
- बिहारी की बहुज्ञता और काव्य–कला, बिहारी का सौंदर्य–बोध।
- रीतिकालीन नीति और भक्ति–काव्य।
- घनानंद के काव्य की भाव–व्यंजना।
- मध्ययुगीन काव्य के माध्यम से जन–जागरण।
- मध्ययुगीन बोध और आधुनिक बोध में साम्य–वैषम्य।

<u>इकाई –IV स्वातंत्र्यपूर्व हिंदी काव्य।</u>

- आधुनिकता की अवधारणा, आधुनिकता के उदय की पृष्ठभूमि हिंदी पुनर्जागरण,पुनरूत्थान, भारतेंदु का साहित्यिक प्रदेय, भारतेंदु युग के साहित्य की प्रवृत्तियाँ।
- द्विवेदीयुगीन साहित्य की प्रवृत्तियाँ, राष्ट्रीयता और साहित्य, खडीबोली की प्रतिष्ठा, महावीर प्रसाद द्विवेदी, मैथिलीशरण गुप्त और हरिऔंध।
- छायावाद – उदय की पृष्ठभूमि, कारण, वैचारिकता, प्रभाव, प्रमुख कवि।
- जयशंकर प्रसाद की सौंदर्य चेतना, जीवन–दर्शन, कामायनी में आनंदवाद, कामायनी की विश्व–दृष्टि।
- सुमित्रानंदन पंत की काव्य–भाषा और काव्य–कला।
- सूर्यकांत त्रिपाठी 'निराला' के काव्य का सामातिक पक्ष, प्रगति–चेतना।
- महादेवी का काव्य :– रहस्यवाद, पीड़ा की अभिव्यक्ति, गीति–तत्व।
- छायावादी काव्य में क्ति का उन्मेष, प्रकृति–चित्रण, बिंब और प्रतीक–योजना।

- छायावादी काव्य की प्रमुख प्रवृत्तियाँ और प्रदेय।
- छायावादोत्तर काव्य की पृष्ठभूमि–एवं काव्यधाराएँ।
- छायावादोत्तर काव्य के वैचारिक आधार, प्रभाव, मार्क्सवाद, मनोविश्लेषणवाद, अस्तित्ववाद।
- प्रगतिवाद और प्रगतिशीलता।
- प्रगतिवादी काव्य की विशेषताएँ, नागार्जुन, केदारनाथ अग्रवाल,
- रातधारी सिंह 'दिनकार' का काव्य – सामाजिक बोध, राष्ट्रीयता,जीवन–दर्शनं
- प्रयोगवादी काव्य के अविर्भाव के कारण, प्रयोगधर्मिता, काव्यभाषा, तारसप्तक की भूमिका, अज्ञेय की काव्य–चेतना।
- प्रयोगवादी काव्य की व्यष्टि–चेतना, सौंदर्य–दृष्टि।

इकाई – V स्वातंत्र्योत्तर हिंदी काव्य।

- नई कविता – व्यष्टि–समष्टि बोध, प्रकृत–चित्रण, काव्यभाषा, काव्यरूप।
- गीतिनाट्य – उद्देश्य और शिल्प–पक्ष। द्वितीय–तृतीय–चतुर्थ सप्तक के कवि।
- मुक्तिबोध का काव्य–समाज –बोध, फैंटसी, मार्क्सवाद का प्रभाव।
- रघुवीर सहाय– राजनीतिक चेतना, यथार्थ–बोध।
- कुंवर नारायण – मिथकीय चेतना, काव्य–दृष्टि। नरेश मेहता : जीवन–दर्शन एवं औदात्य।
- धूमिल की विद्रोह–चेतना, काव्य–भाषा।
- स्वातंत्र्योत्तर हिंदी काव्य में काल संसक्ति और लोक–संसक्ति।
- उत्तरशती के प्रमुख कवि–चंद्रकांत देवताले, ज्ञानेंद्रपति, राजेश जोशी, अरूण कमल, त्रिलोचन, बलदेवी वंशी, अनामिका।
- जनवादी काव्य और सर्वेश्वरदयाल सक्सेना।

इकाई – VI स्वातंत्र्यपूर्व/ स्वातंत्र्योत्तर हिंदी गद्य साहित्य।

- भारतेंदु युग – नाटक, निबंध, उपन्यास, कहानी साहित्य।
- भारतेंदु मंडल का गद्य साहित्य। भारतेंदु के नाटक और स्वाधीनता की चेतना।
- भारतेंदु युगके समाचार–पत्र। समाचार पत्र और साहित्य का संबंध।

- द्विवेदीयुग – उपन्यास, कहानी, निबंध, नाटक, आलोचना साहित्य।
- हिंदी उपन्यास में नायक–नायिका की अवधारणा, उसके बदलते स्वरूप।
- प्रेमचंद के उपन्यास, 'गोदान' और भारतीय किसान, गोदान का होरी और धनिया, गोदान उपन्यास की महाकाव्यात्मकता।
- हिंदी उपन्यास और मनोवियलेषणात्मक चितंन, सिध्दांतों का प्रभाव।
- प्रसाद के कहानी साहित्य का प्रदेय। प्रेमचंद की कहानी में आदर्श और यथार्थ।
- मध्यवर्ग का उदय, और उपन्यास, कहानी साहित्य।
- आंचलिक उपन्यास, प्रमुख आंचलिक उपन्यासकार, आचंलिक कहानी और कहानीकार। आचंलिक उपन्यासों की विशेषताएँ।
- मैला आँचल :– वस्तु, शिल्प, पात्र, परिवेश, सामाजिक–चित्रण, उद्देश्य।
- हिंदी के ऐतिहासिक उपन्यासकार और उपन्यास।
- 'बाणभट्टी की आत्मकथा' – इतिहास और कल्पना, सांस्कृतिक–सामाजिक चित्रण, नारी–चित्रण, औपन्यासिक शिल्प।
- अज्ञेय के उपन्यास, शेखर:एक जीवनी' का नायक, मनोवैज्ञानिक आयाम।
- धर्मवीर भारती का कहानी साहित्य।
- राजेंद्र यादव, मन्नू भंडारी का उपन्यास और कहानी साहित्य।
- नई कहानी की संवेदना, शिल्प, आधुनिकता बोध। प्रमुख नये कहानीकार।
- प्रसादोत्तर नाटक – प्रयोगधर्मिता और नाट्य–भाषा, प्रमुख नाटककार।
- 'आधे–अधूरे' – नाटक का आधुनिकता बोध, मूल्य–चित्रण।
- लक्ष्मीनारायण लाल के नाटकों की वस्तु ओर रंगमंचीयता। सर्वे□रदयाल सक्सेना के नाटक।
- शंकर शेष के नाटकों की प्रतीकात्मकता और प्रयोगधर्मिता।
- <u>निंबध</u>

  I. चिंतामणी भाग – १ – आचार्य रामचंद्र शुक्ल

  II.. भाषा साहित्य और देश – हजारीप्रसाद द्विवेदी

  १. भा ाा साहित्य देश
  २. भा ाा योजना की समस्या

३. स्वराज्य और स्वभा ा
४. हिंदी भा ा और हिंदी के विगत पच्चीस व ा
५. हिंदी में उच्चस्तरीय पुस्तके
६. भारतीय चिंतनधारा: साहित्य के क्षेत्र में
७. रामचरित्र मानस : दिव्य प्रेरणा की अप्रतिम कृति
८. चैतन्य की महिमा की प्रति ठा
९. आधुनिक लेखकों का उत्तरायित्व
१०. उच्चशिक्षा
११. पुस्तकालय : सत मिलन का उत्तम मार्ग
१२. भारतीय संस्कृति

III. आंगन का पंछी और बंजारा मन – विद्याविलास मिश्र

- निबंधकार – आचार्य रामचंद्र शुक्ल, हजारीप्रसाद द्विवेदी, कुबेरनाथ राय, विद्यानिवास मिश्र।
- शुक्लोत्तर निंबध साहित्य में संस्कृति बोध, जीवन बोध, लालित्य, लोक– संस्कृति।
- हजारीप्रसाद द्विवेदी के निबंधों में संस्कृत–साहित्य के संदर्भ एवं भाषा–चितंन।
- आचार्य रासमचंद्र शुक्ल की आलोचना दृष्टि, रस–दृष्टि, लोकमंगल की अवधारणा।
- रामविलास शर्मा – मार्क्सवादी आलोचना।
- नंददुलारे वाजपेयी – सौष्ठववादी आलोचना।
- डॉ. नगेंद्र – काव्यशास्त्रीय आलोचना।
- रमेश कुंतल मेघ – सौंदर्यशास्त्रीय आलोचना

इकाई –VII उत्तरशती के कथा साहित्य में स्त्री–विमर्श तथा दलित–विमर्श

(A) स्त्री–विमर्श – मैत्रेयी पुष्पा के उपन्यास एवं कहानी–संग्रह।

प्रभा खेतान के उपन्यास। चित्रा मुद्गल के उपन्यास कहानी संग्रह।

महिला कथाकारों की आत्मकथाएँ।

कुर्रतुल–ऐन–हैदर, नासिरा शर्मा के उपन्यास।

अलका सरावगी के उपन्यासों में सामाजिक–चित्रण।

कृणा सोबती के उपन्यास, कहानियों के नारी पात्र।

रमणिका गुप्ता के साहित्य में शोषण के विविध रूप और नारी–जागरण।

स्त्री कथाकारों द्वारा प्रस्तुत नारी–चित्रण, नारी–मन,नारी–यथार्थ, नारी–आकांक्षाएँ स्त्री कथाकारों के साहित्य का शिल्प एवं भाषा।

(B) दलित–विमर्श – दलित आत्मकथाएँ और आत्मकथाकार–मोहनदास नैमिशराय, सूरजपाल चौहान, भगवानदास, ओमप्रकाश वाल्मीकि, कौशल्या बैसंत्री, यौराजसिंह बेचैन, बलवीर माधोपुरी, माता प्रसाद, सूरजपाल बडजात्या, आदि।

उत्तरशती के दलित उपन्यास, दलित काव्य, दलित नाटक

दलित साहित्य की भूमिका, उद्देश्य, मानवता का पक्षधर साहित्य, दलित साहित्य की भाषा, शिल्प,सौंदर्यशास्त्र।

हिंदी का आदिवासी साहित्य और साहित्यकार।

भूमंडलीकरण और दलित साहित्य।

उत्तर मार्क्सवाद और दलित साहित्य।

इकाई – VIII भारतीय काव्यशास्त्र

- काव्य–हेतु और काव्य–प्रयोजन।
- काव्यशास्त्र के सिध्दांत – रस, ध्वनि, वक्रोक्ति, औचित्य।
- काव्य में अलंकार का स्थन, अलंकार और रस।
- काव्य रीति, शैली, आचार्य वामन का रीति सिध्दांत, रीति और गुण।
- साधारणीकरण सिध्दांत, सह्रदय की अवधारणा, आचार्य रामचंद्र शुक्ल का चिंतन।
- करूण, बीभत्स, भयानक, रौद्र के रसास्वादन की संकल्पना और विश्लेषण।
- शैलीवैज्ञानिक आलोचना प्रणाली।

इकाई – IX पाशत्य काव्यशास्त्र एवं आलोचना।

- लोंजाइनस का उदात्त सिध्दांत
- अरस्तू के महाकाव्य तथा नाटक विषयक सिध्दांत
- वर्डस्वर्थ का काव्यभाषा चितंन
- कॉलरिज का कल्पना सिध्दांत
- क्रोचे का अभिव्यंजनावाद

- आई.ए.रिचर्डस् का संप्रेषण सिध्दांत
- टी.एस्.इलियट का निर्वैयक्तिकता और वस्तुनिष्ठ प्रतिरूपता सिध्दांत।
- रूसी रूपवाद, संरचनावाद, उत्तर–संरचनावाद
- प्रतीक और बिंब सिध्दांत
- आधुनिकता और उत्तर आधुनिकता।
- नयी समीक्षा। नयाी समीक्षा की अवधारणाएँ – विडंबना, अजनबीपन, विसंगति, तनाव, अंतर्विरोध, विखंडन।
- आलोचना प्रणालियाँ – स्वच्छंदतावादी, सैध्दांतिक, निर्णयात्मक, मार्क्सवादी, कलावादी, तुलनात्मक, ऐतिहासिक, समाजशास्त्रीय, मनोवैज्ञानिक एवं मनोविश्लेषणात्मक।

इकाई –X ससंदर्भ स्पष्टीकरण हेतु पाठयक्रम–निर्देश

- विद्यापति – संपा. आनंदप्रकाश दीक्षित – पद संख्या – २० से ६०
- कबीर – संपा. हजारीप्रसाद द्विवेदी – दोहा – पद संख्या – १६५ से २०५
- जायसी – पद्मावत – नखशिख वर्णन खंड।
- सूरदास – भ्रमरगीतसार – संपा. रामचंद्र शुक्ल – पद संख्या – ३१ से ७५
- तुलसीदास – रामचरितमानस – गीताप्रेस गोरखपूर– उत्तरकांड।
- बिहारी रत्नाकर – संपा. जगन्नाथदास रत्नाकर – दोहे १०१ से १५०
- कामायनी – चिंता और श्रध्दा सर्ग।
- नरेश मेहता – महाप्रस्थान।
- नागार्जुन – भस्मांकुर ।
- अज्ञेय – नदी के द्वीप, असाध्यवीणा।
- निराला – राम की क्तिपूजा।
- रामधारी सिंह 'दिनकर' – रश्मिरथी।
- मुक्तिबोध – 'चाँद का मुँह टेढा है।', 'ब्रहमराक्षस'
- धूमिल – पटकथा। मोचीराम।

- उपन्यास – १. गोदान – प्रेमचंद ।
  २. मैला आँचल – फणिश्वरनाथ रेणु।
  ३. शेखर एक जीवनी (भाग १ व २) – अज्ञेय
  ४. तमस – भीष्म साहनी।

- नाटक – १. मोहन राकेश – लहरों के राजहंस।

२. शंकर शेष – पोस्टर।
३. आठवाँ सर्ग – सुरेंद्र वर्मा।
४. कर्फ्यू – लक्ष्मीनारायण लाल।
५. बकरी – सर्वेश्वरदयाल सक्सेना।

- कहानी – १. कफन – प्रेमचंद।
२. ऊँचाई – मन्नू भंडारी।
३. गुल की बन्नो – धर्मवीर भारती।
४. पहाड – निर्मल वर्मा।
५. पिता – ज्ञानरंजन।
६. पाल गोमरा का स्कूटर – उदयप्रकाश।
७. मलबे का मालिक – मोहन राकेश।
८. दिल्ली में एक मौत – कमलेश्वर।
९. पर्दा – यशपाल।
१०. टूटन – राजेंद्र यादव

इकाई –XI भारतीय साहित्य

- भारतीय साहित्य की अवधारणा, भारतीयता और साहित्य।
- भारतीय साहित्य का स्वरूप और समस्याएँ
- भूमंडलीकरण और भारतीय साहित्य
- भारतीय साहित्य विम र्श के मानदंड
- अनुवाद और भारतीय साहित्य
- भारतीय साहित्य का तुलनात्मक परिप्रेक्ष्य
- अध्ययनार्थ भारतीय साहित्य – १. बलुतं – दया पवार (मराठी)
२. संस्कार – अनंतमूर्ति (कन्नड)
३. मृत्युंजय – वीरेंद्र भट्टाचार्य (असमिया)
४. गणदेवता – ताराशंकर बंधोपाध्याय (बंगाली)
५. मामूली चीजों का देवता – अरूंधती राय (अंग्रेजी)

संदर्भ – पुस्तक–सूची

१. ोध प्रविधि – डॉ. विनयमोहन ार्मा
२. साहित्य सिध्दांत और ोध – डॉ. आनंदप्रकाश दीक्षित
३. हिंदी ोध तंत्र की रूपरेखा – डॉ. मनमाकहन सहगल
४. ोध प्रक्रिया एवं विवरणिका – डॉ. सरनाम सिंह
५. नवीन ोध विज्ञान – डॉ. तिलकसिंह
६. ोध स्वरूप एवं मानक व्यावहारिक कार्यविधि – डॉ. बैजनाथ सिंहल
७. मध्यकालीन साहित्य विमर्श – डॉ. सुधा सिंह
८. हिंदी साहित्य का इतिहास – डॉ. नगेंद्र
९. हिंदी साहित्य का दूसरा इतिहास – डॉ.बच्चनसिंह
१०.साहित्य और इतिहास दृ ि ट – डॉ. मैनेजर पांडेय
११.उत्तर आधुनिकता: साहित्य विमर्श – डॉ. सुधीर पचौरी
१२.साहित्य का समाजशास्त्र – डॉ. निर्मला जैन
१३.भारतीय साहित्य – डॉ. लक्ष्मीकांत पांडेय, डॉ. प्रमिला अवस्थी
१४.भारतीय साहित्य विमर्श – संपा. डॉ. रातजी तिवारी
१५.भारतीय साहित्य : तुलनात्मक परिप्रेक्ष्य – इंदुनाथ चौधुरी
१६.भारतीय साहित्य : अवधारणा, स्वरूप और समस्याएँ – के. सच्चिदानंद
१७.आधुनिकता के आईने में दलित – संपा. अभयकुमार दुबे
१८.दलित संघ ि और सामाजिक न्याय – डॉ. पूरणमल
१९.सामाजिक न्याय एवं अलित संघ ि – राजस्थान हिंदी ग्रंथ अकादमी, जयपुर डॉ. रामगोपाल सिंह
२०.साहित्य और दलित चेतना – महीपसिंह, चंद्रकांत बोदिवडेकर
२१.हिंदी साहित्य औा दलित अस्मिता – डॉ. कालीचरण स्नेह
२२.औरत : उत्तरकथा – संपा. राजेंद्र यादव, अर्चना वर्मा
२३.उपनिवेश में स्त्री – प्रभा खेतान
२४.स्त्रीत्ववादी विमर्श – डॉ. क्षमा ार्मा
२५.स्त्री–अस्मिता – तगदीश चतुर्वेदी, सुधा सिंह
२६.तुलनात्मक साहित्य – संपा. डॉ. राजमल बोरा
२७.भा ाा साहित्य और देश – हजारी प्रसाद द्विवेदी – भारतीय ज्ञानपीठ १८, इनस्टिटयूशन एरिया, लोधी रोड, नयी दिल्ली – ११० ००३
२८.उत्तरशती का हिंदी साहित्य – संपा. डॉ. सुरेश कुमार जैन – अन्नपूर्णा प्रकाशन, कानपुर –२०८ ०१४

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. पीएच. डी. प्रवेश परीक्षा

मराठी विषयासाठीचा अभ्यासक्रम

एकूण गुण	— १००
वस्तुनिष्ठ प्रश्न	— २०
भाषा व लेखनविषयक क्षमता	— ८०
लघुत्तरी व दीर्घोत्तरी प्रश्न	

अभ्यासक्रमाचे घटक :

१. साहित्य समीक्षा: स्वरूप व कार्य, भारतीय साहित्यसिद्धांत — ध्वनि, रस, रीति.

२. मध्ययुगीन आणि आधुनिक मराठी साहित्याचा इतिहास — इ.स. २००० पर्यत.

(प्रमुख ग्रंथकार, ग्रंथ, प्रवृत्ती व प्रवाह.)

३. लेखकाच्या अभ्यासाचे स्वरूप व मराठीतील प्रमुख लेखकाभ्यास.

४. साहित्यप्रकाराभ्यास : साहित्यप्रकाराचे स्वरूप, प्रमुख साहित्यप्रकारांची मीमांसा.

५. साहित्याभास व भाषाभ्यास यांचा परस्परसंबंध.

६. साहित्याचा सामाजिक दृष्टिकोनातून अभ्यास.

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Exam Pattern & Syallabus of Ph.D. Entrance Exam

Paper-II, Pali Or Buddhist Studies,

Total Marks 100
Descriptive Questions 80 Marks
Objective Questions 20 Marks

N.B. 1) A Candidate is required to answer any four descriptive questions out of seven.

2) Each question is comprised of three parts concerning
a) Pali Language and Literature
b) Sanskrit Buddhist Literature and
c) Buddhist Philosophy and History
candidate is required to answer any part out of the three

3) Each descriptive question carries 20 Marks

4) All objective questions are compulsory and carry 2 Marks each

Syllabus

1. **Pali Language:**
Origin homeland of Pali & Pali Grammar

2. **Pali Canonical Literature:**
Vinayapitaka, Suttapitaka, Abhidhammapitaka

3. **Pali Commentarial Literature**:
Atthakathas & Tikas.

4. **Others**:
Kavya Literature, Cronicals, Prosody, Rhetoric

5. **Earlier Sanskrit Buddhist Texts**:
Sarvàstivàda Vinaya, Mahàvastu, Lalitavistara, Works of Asvaghosa,
Avadàna Literature

6. **Mahàyàna Såtras:**
Saddharmapuõóarãkasåtra, Kàraõóavyåha, Sukhàvatãvyåha,
Saddharmalaïkavatàrasåtra, Samàdhiràjasåtra, Suvarõaprabhàsasåtra.

7. **Philosophical Texts:**

Works of Nàgàrjuna, âryadeva, Asaïga, Vasubandhu, Bhàvaviveka, Candrakãrti, Dinnàgu, Dhamrmakirti, Sàntideva, Sàntarakùita and Kamalasãla.

8. **Stotras:**

Storas, Dhàraõãs And Tantra Literature

9. Buddhism as Religion and Philosophy:

The Place of Religion, Dogmas in Buddhism

10. Issues concerning the doctrines of Karma and Rebirth

11. Centrality of Ethics:

Implications of Buddhist Ethics to Caste and Gender,

Sila, Samadhi, Prajna and Brahmavihara, Paramita

12. Avyakrtaprasnas and the Buddha's Silence

13. Arguments for Ksanikata (Dharmkirti), Vijnaptimatratasiddhi (Vasubandhu) and sunyata (Nagarjuna)

14. Technical terms in the Buddhist Abhidhamma:

Citta, Caitasika, Rupa, Nirvana, Skandha, Ayatana, Dhatu, Dhyana, Paramita,

Bodhipaksiya Dharma

15. Background of Buddhism as a reaction to Vedic and Upanisadic Thought

16. Contemporary Philosophical Sects:

Brahmajala Sutta and Sramanyaphalasutta

17. Life and mission of the Buddha:

Parivrajya, Dhammacakkappavattanasutta, Parinirvana

18. Teachings of the Buddha:

Threefold division: Vinaya, Sutta and abhidhamma

19. Four noble truths, Pratityasamutpada, Dvadasanidana:

The doctrines of Anityata and Anatta, Eightfold path, the concept of Nirvana

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History of Pali Language & Literature

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16. Buddhism. C. Humphreys, Penguin Books, H. Middlesex, 1952.
17. Buddhism as a religion: Its Historical Development and its Present conditions. H. Nakamura, Neeraj Publishing House, Delhi, 1982.
18. Buddhism. David Shuman, ?
19. History of Indian Philosophy: Dasgupta S. N.
20. Outlines of Indian Philosophy: Hirianna M.
21. Introduction to Indian Philosophy: Mohanty J.

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पी. एच्. डी. प्रवेशपरीक्षा
प्रश्न पत्रिका क्र. २
विषय — संस्कृत
प्रश्नपत्रिका आराखडा

एकूण गुण — १००
विस्तृत प्रश्न — ८० गुण
वस्तुनिष्ठ प्रश्न — २० गुण
प्रश्नपत्रिका संस्कृतमध्येच असेल.
उत्तरपत्रिकेचे माध्यम — संस्कृत/इंग्रजी/मराठी

प्र. १. वस्तुनिष्ठ प्रश्न — २० प्रश्न, प्रत्येक प्रश्नास १गुण — २० गुण

(वेद, व्याकरण, वेदान्त, मीमांसा, न्याय, दर्शन, साहित्य, साहित्यशास्त्र या संपूर्ण अभ्यासक्रमावर आधारित)

प्र. २. वैदिक वाङ्मय आणि वेदांग (संहिता, ब्राह्मण आरण्यक, उपनिषदे व्याकरण, शिक्षा, कल्प, निरुक्त, छंद, ज्योतिष यावरील प्रश्न) (दोनपैकी १ सोडविणे)—२० गुण

प्र. ३. साहित्य / साहित्यशास्त्र — काव्य, नाटक,रूपक, काव्यशास्त्र—सिद्धान्त. (दोनपैकी १ सोडविणे) —२० गुण

प्र. ४. षड्दर्शने (सर्वदर्शनसंग्रहातील षड्दर्शने) (दोनपैकी १ सोडविणे) — २० गुण

प्र. ५. — संस्कृत निबंध (तीनपैकी १) २० गुण

—: अभ्यासक्रम :—

१. वैदिक वाङ्मयाची सामान्य ओळख — चारही वेदांच्या संहिता, त्यांच्या शाखा, विषय, स्वरूप.
ब्राह्मण ग्रंथांचे स्वरूप, शैली, विषय.
प्रमुख उपनिषदे, त्यांचे स्वरूप आणि त्यातील विषय आणि तत्त्वज्ञान
सहा वेदांगे, त्यांचे स्वरूप आणि त्यातील विषय, त्यांचे महत्त्व.

२. साहित्य आणि साहित्यशास्त्र — आर्षमहाकाव्यांचे स्वरूप, विषय, वैशिष्ट्ये

पंचमहाकाव्ये त्यांचे कवी, विषय, भरताचे नाटयशास्त्र त्याचे विषय आणि स्वरुप, प्राचीन संस्कृत नाटके उदा. — स्वप्नवासदत्त, शाकुन्तल, उत्तररामचरित, मुद्राराक्षस आणि मृच्छकटिक, काव्यप्रयोजने, काव्यलक्षण, काव्यहेतू, काव्यप्रकार (मम्मट व विश्वनाथ यांच्या आधारे).

३. दर्शनशास्त्र — षड्दर्शनांची ओळख, त्यांचे कर्ते, त्यातील तत्त्वज्ञान.

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Ph.D. Entrance Examination
Question paper II
Subject- Sanskrit
Question paper format

Total Marks- 100 Marks
Descriptive Questions- 80 Marks
Objective Questions-20 Marks

Note- The medium of question paper will be Sanskrit.
Answers could be given in Sanskrit/ English/ Marathi.

Q.1. Objective questions- 20 questions in all. Each question will carry 1 mark - Total 20 Marks
(Based on the syllabus of Veda, Grammar, Vedanta, Mimamsa, Nyaya, Darshana, Sahitya & Sahityashastra).
Q.2.Vedic Literature (Questions based on Samhitas/ Brahmana-texts/ Aranyakas/ Upanishadas/ Vyakarana/ Shiksha/ Kalpa/ Nirukta/ Chanda / Jyotisha). (A candidate is supposed to answer one out of two questions.)
- Total 20 Marks
Q.3.Sahitya & Sahityashastra- Poetry/ Dramas/ Theories of Poetics etc. (A candidate is supposed to answer one out of two questions.)
-Total 20 Marks
Q.4.Darshanashastra (Six Darshanas from the सर्वदर्शनसंग्रह). (A candidate is supposed to answer one out of two questions.)
-Total 20 Marks
Q.5.Sanskrit Essay (A candidate is supposed to write one essay out of three). - Total 20 Marks

Syllabus

1. General Introduction to Vedic Literature.

Nature, Subject-matter & Specialties of i) The Samhitas of the four Vedas & their branches, ii) The Brahmana-texts, iii) The Aranyakas, iv) The major Upanishadas & v) Six Vedangas.

2. General Introduction to Sahitya & Sahityashastra.

Nature, Subject-matter & Specialties of Ramayana & Mahabharata.
The Five Mahakavyas- the poets & topics.
Sanskrit dramas such as Abhijnanasakuntala, Svapnavasavdatta, Uttararamacharita, Mudrarakshasa & Mrucchakatika.
Introduction to Bharata's Natyasastra, Five Schools of Poetics, Kavyaprayojanas, definition of Poetry, Kavyahetu & classification of Poetry according to Mammata & Vishvanatha.

3. Introduction to Darshanashastra

Introduction to Six Darshanas, their Authors & Philosophy.

Bibliography

२. History of Sanskrit Literature – A.B.Keith,

Gonda,

Macdonell,

Winternitz.

२. संस्कृत साहित्याचा सोपपत्तिक इतिहास — करंबेळकर.

३. महाराष्ट्रीय ज्ञानकोश — वेदविद्याखंड (चतुर्थखंड) — ग. वि. केतकर.

४. History of Poetics - P.V. Kane.

History of Sanskrit Poetics – S. K. De.

५. काव्यशास्त्राचा इतिहास — केतकर, (मराठी अनुवाद) मूळ इंग्रजी लेखक काणे

६. अभिजात संस्कृत साहित्याचा इतिहास — मंजूषा गोखले, गौरी माहुलीकर, उमा वैद्य.

History of classical Sanskrit Literature – De- Dasgupta

७. भारतीय तत्त्वज्ञान — श्रीनिवास दीक्षित.

८. Outlines of Indian Philosophy – Hiriyanna.

९. भारतीय तत्त्वज्ञानाची रूपरेषा — ग. वि. केतकर.

१०.भारतीय तत्त्वज्ञानाचा बृहद् इतिहास — ग. ना. जोशी.

११. History of Indian Philosophy – S. N. Dasgupta

१२. सर्वदर्शनसंग्रह — (मराठी अनुवाद). र. पां. कंगले

प्राकृत

एकूण गुण — १००
वस्तुनिष्ठ प्रश्न — २० गुण
विस्तृत प्रश्न — ८० गुण

प्र. १) भाषाशास्त्र, व्याकरण आणि शिलालेख — प्राकृत भाषाविज्ञान, प्राकृत भाषा स्तर, स्वर व्यंजन बदल, विविध प्राकृत भाषा वैशिष्ट्ये यावर आधारीत कोणत्याही दोन प्रश्नांपैकी एक सोडवणे (१६ गुण)

प्र. २) आगमसाहित्य — दिगंबर आणि श्वेतांबर आगमसाहित्याची रूपरेषा.यावर आधारीत

कोणत्याही दोन प्रश्नांपैकी एक सोडवणे (१६ गुण)

प्र. ३) आगमव्याख्यासाहित्य — दिगंबर आणि श्वेतांबर आगमसाहित्यावरील व्याख्यासाहित्य. यावर आधारीत कोणत्याही दोन प्रश्नांपैकी एक सोडवणे (१६ गुण)

प्र. ४) साहित्य, साहित्यशास्त्र — कथा, चरित्र, काव्य, सट्टक, नाटकीय प्राकृत, शास्त्रीय साहित्य, छंद, अलंकार.यावर आधारीत कोणत्याही दोन प्रश्नांपैकी एक सोडवणे (१६ गुण)

प्र. ५) तत्त्वज्ञान — जैन तत्त्वज्ञानावर आधारीत. कोणत्याही दोन प्रश्नांपैकी एक सोडवणे (१६ गुण)

प्र. ६) सामान्य प्रश्न — वस्तुनिष्ठ प्रश्न — २० प्रश्न, प्रत्येक प्रश्नास १गुण

(संपूर्ण अभ्यासक्रमावर आधारित) — २० गुण

Prakrit

Q.1-	Linguistics, Grammar , Inscriptions-	Prakrit Linguistics , Level of Prakrit Language, vowel and consonant changes , special features of different prakrit languages- (1 out of 2) (16 Marks)
Q.2-	Canonical Literature-	Outline of Digambara and Shwetambara Canonical Literature-(1 out of 2). (16 Marks)
Q.3-	Commentarial Literature -	Commentaries on Digambara & Shwetambara canons-(1 out of 2) . (16 Marks)
Q.4-	Literature, Poetics and Dramaturgy -	Narrative Lit., Biographies, Poetry, Sattaka Dramatical Prakrits, Scientific Literature, Meters, Figures of speech- (1 out of 2). (16 Marks)
Q.5-	Philosophy	Jain Philosophy-(1 out of 2). (16 Marks)
Q.6.-	General Question-	Objective questions- 20 questions in all. Each question will carry 1 mark -Total 20 Marks (Based on the entire syllabus)

Syllabus

Q.1- Place of Prakrit in Indo Aryan Group of Languages, development of Prakrit, Grammar vowel and consonant change, special features of egkjk'Vªh , शौरसेनh , अर्धमागधी , पैशाची , संधी , declensions, verbs etc.

Q.2- Number of canons, subject matter and language of canons

Q.3- Variety of commentaries e.g. pwf.kZ , Vhdk , etc.

Q.4- Narratives in canons and commentarial Literature, Vasudevahindi Samaraiccakaha, Kathakosaprakarana, Kuvalayamalakaha, Akhyanamanikosa, Kumaravalapadiboha,
Didactical Literature- Uvaesamala Uvaesapada, Dharmopadeshamalavivarana
Biographical Literature- Poumachariya, Jamabucariya, Suva-sundaricariya, Rayanacudarayacariya, Pasanahacariya, Maha-Viracariya. Apabharamsa- Karakandacariu, Paumcariu
Poetry- Gahasattasai, Vajjalagga, setubandha,
Gaudavaho, Lilavai, Kumaravalacariya, Kamsavaho, Usaniruddha
Sattaka – different sattakas, their theme, language, author, and period.
Dramatical Prakrit- Variety of Prakrit used in Sanskrit dramas by Hkkl , dkfynkl , HkoHkwfr , e`PNdfVd , eqækjk{kl , os.khlagkj
Scientific Literature- jktuhfr, vFkZ"kkL=, T;ksfr'k~ , रत्नiरी{kk , æO;iरी{kk etc.
Meters- o`rtkfrleqPp; , xkgkyD[k.k , प्राकृतपैङ्गल ,

Q.5- Jain Philosophy- Tattavarthasutra, Pancastikaya, Pravacanasara, Atthapahuda,

Barasanuvekkha, Bhagavatiaradhana, Mulacara, Gommatasara, Dravyasamgraha etc.

Bibliography

१) पाइय सद्द महण्णव (प्राकृत शब्दकोश) — हरगोविंददास सेठ
२) अर्धमागधी घटना आणि रचना — मंगरुळकर, अर्जुनवाडकर
३) Introduction to Ardhamagadhi - Dr. A. M. Ghatge
४) Introduction to Ardhamagadhi - Woolner
५) प्राकृत साहित्य का इतिहास — डॉ. जगदीशचंद्र जैन.
६) History of Prakrit Literature – Dr. Jagdishchandra Jain.
७) प्राकृत साहित्य का बृहद् इतिहास (एकूण १२ खंड) — गुलाबचन्द्र चौधरी.
८) जैन धर्म आणि तत्त्वज्ञान — डॉ. सिंधू डांगे
९) जैन तत्त्वज्ञान कोश १ ते ४ खंड.
१०) भारतीय तत्त्वज्ञान — श्रीनिवास दीक्षित

११) Outlines of Indian Philosophy – De Dasgupta
१२) Prakrit Language — Dr. A. N. Upadhye.
१३) Prakrit Grammar - Dr. Pischel

UNIVERSITY OF PUNE
Model Paper for Entrance Test in French for M. Phil. and Ph. D. Programmes

SYLLABUS : M. Phil. and Ph. D. aspirants should be familiar with the MA syllabus (2009) of the University of Pune

The following topics are covered in the syllabus :

1) Theory of translation

2) Linguistics - Phonetics, Phonology, Morphology, Morphonology, Syntax, Semantics

3) French Language Teaching – principles, objectives, language skills, planning, evaluation types.

4) Literature : French literature – doctrines : renaissance, classicism, romanticism, realism, surrealism. Genres : poetry, theatre, novel, short story. Span : Middle Ages to 20th Century.

Francophone Literature – general idea about French speaking countries and their literature of French expression.

WEIGHTAGE FOR THE ABOVE FOUR BROAD AREAS – roughly 25% per area.

DESCRIPTIVE QUESTIONS 80 marks

One long answer question with internal choice (1/3) 30 marks

Two questions of 25 marks each with internal choice (2/5) 50 marks

Sample questions –

1) Expliquez à l'aide d'un exemple les procédés de la traduction.

2) Traduction – art ou technique

3) La langue est un système de sous-systèmes. Elaborez.

4) Le niveau d'inscription du sens dans un discours.

5) Le rapport entre l'approche de l'enseignement et l'évaluation.

6) L'évolution des approches de l'enseignement du FLE.

7) Citations à illustrer à l'aide des exemples concrets – (eg. << La poésie romantique français, dès l'origine, a pour maître-mot l'émotion. >> Illustrez en vous reportant aux exemples concrets.)

8) Tracez les caractéristiques du classicisme / romantisme / réalisme / surréalisme français à l'aide des exemples littéraires.

OBJECTIVE QUESTIONS 20 marks

Sample questions –

A. Choisissez la bonne réponse :

1) L'auteur de la théorie interprétative

a) Jean Delisle b) Eugène E Nida c) Danika Seleskovitch

2) L'emprunt réfère à

a) la traduction littérale b) l'usage du même mot de la langue de départ

c) la modulation

3) Le chassé-croisé est un type de

a) transposition b) modulation c) équivalence d) tous les trois

B. Complétez :

1. Le français se sert des points d'articulation suivants: _____, _____, _____, _____, _____ et _____.

2. Quelles sont les sourdes parmi les consonnes suivantes : /p/, /t/, /z/, /k/.

3. Donnez un exemple des formes canoniques suivantes :--
CCVCC VCCC CCV
CVCC CCVC
C. Précisez à l'aide d'un exemple le sens des concepts suivants:
(i) dérivation (ii) flexion (iii) sens connotatif (iv) antonymie contextuelle (v) évaluation sommative
D. Nommez : -
a) trois pièces de Molière. b) deux auteurs ayant écrit l'autobiographie et leurs titres. c) deux recueils de nouvelles du 20ème siècle. d) le dramaturge français qui représente la tragédie. e) la pièce qui annonce la révolution française et son auteur

Subject: Russian

PROPOSED SYLLABUS & QUESTION PAPER PATTERN FOR M.Phil – Ph.D. ENTRANCE TEST

Note:
The Question Paper will carry 100 marks. It will consist of two sections. Time allotted will be 2 hours.

Section 1 will carry 80 marks. . It will contain 6 to 7 Descriptive questions, framed on Modern Russian Language, Russian Literature, Culture & Civilization. Each question will carry 16 marks. The student will have to answer any 5 questions.

Section 2 will carry 20 marks. It will contain 20 Objective Type Questions (Multiple Choice, Matching Type, True/False, Assertion-Reasoning Type) carrying 2 Marks each. The questions will test candidates' knowledge of Practical Russian grammar & Modern Russian language, Russian literature, Culture & Civilization. The candidates will answer any 10 questions.

PRACTICAL RUSSIAN GRAMMAR

1. **Nouns, Adjectives & Pronouns, Gender, Number, Declensions**
2. **Numerals**
3. **Verb – Aspect; Verbs of Motion, Verbal Prefixes**
4. **Full & Short Form Adjectives**
5. **Verbal Adverbs**
6. **Participles**
7. **Active & Passive Voice**
8. **Direct & Indirect Speech**
9. **Degree of Comparison of Adverb & Adjective**

MODERN RUSSIAN LANGUAGE

Phonetics:
Sound system of Russian and its classification, Reduction of sounds, Change of sounds, Stress & types of intonation

Lexicology:
Meaning of word, Polysemy, Synonyms, Antonyms, Homonyms, Paronyms, Russian vocabulary, Phraseology, Types of Dictionaries

Morphology:
Morphology and morphemic structure of a word, Parts of Speech in Russian, Word formation

Syntax:
Types of phrases, Syntactic relations, Simple sentence, Types of sentences, Components of sentences, Complex & Compound sentences & their types.

LITERATURE

1) **Major literary periods:- Russian literature up to the 19th century, 19th Century, 20th Century**
2) **Main literary movements:- Classicism, Romanticism, Realism, Critical Realism**
3) **Distinctive features of main literary genres**
4) **Authors: Basic knowledge of important biographical details and major works of the following authors and their contribution to literature. – A.Griboedov, A.Pushkin, M.Lermontov, N.Gogol, I.Turgenev, F.Dostoevsky, Leo Tolstoy, A.Chekhov, A.Ostrovsky, I.Bunin, M.Gorky, V.Mayakovsky, A.Blok, S.Esenin, M.Sholokhov, B.Pasternak, V.Shukshin, V.Rasputin, E.Evtushenko, A.Tvardovsky, A.Solzhenytsin, Anna Akhmatova, Marina Tsvetaeva, Ch.Aitmatov, M.Bulgakov, V.Astafyev**

CULTURE & CIVILIZATION

1. **History & Geography of Russia**
2. **Russian customs**
3. **Russian artists & art galleries**

SAMPLE QUESTIONS

Section I

1. **Расскажите о жизни и творчестве А.С.Пушкина. Каково значение его творчества?**
2. **Что вы можете рассказать об озвончении и оглушении звуков в русской речи?**

Section II

1. **Отметьте, к какому разряду прилагательных относится прилагательное «СОБАЧИЙ» - (а) к качественному (б) к относительному (в) к притяжательному (г) к порядковому**
2. **Отметьте, какой из следующих местоимений не имеет формы рода. – (а) сам (б) весь (в) кто (г) какой**
3. **Отметьте, кто из следующих русских писателей был лауретом нобелевской пермии? (а) И. Бунин (б) А.Куприн (в) М.Горький (г) В. Шукшин**

Ph.D. Entrance Examination in Commerce

Syllabus Under the Optional Subject – Groups (A to D)

A. Business Administration, Business Practices and Marketing,

(i) Elements of Business Environment : Social and Economic Environment, Government Policies, Principles of Management, Planning, Control, Direction, Motivation, Leadership Home Trade-Organized Retailing – Features of International Trade Strategic Management. : Principles Styles and types.

(ii) Management of Human Capital, Human Resource Planning, Job analysis, job description and specifications, Recruitment and Selection - Training and Development-Succession Planning. Compensation: Wage and Salary administration, Incentives and Fringe benefits, Morale and Productivity. Performance Appraisal- Industrial Relations in India, Health, Safety, Labour Welfare and Social Security, Workers' Participation in Management

(iii) Marketing : Tasks, Concepts and Tools, Marketing Environment, Consumer Behavior and Market Segmentation, Product decisions, Pricing decisions, Distributions decisions, Promotion decisions, Direct Marketing; Social, and ethical aspects of Marketing in India.

B. Advanced Accounting & Auditing, Advanced Cost & Works Accounting :

(i) Basic Accounting concepts, Capital and Revenue, Financial Statements analysis. Partnership Accounts: Admission, Retirement, Death, Dissolution and Cash Distribution, Advances. Company Accounts : Issue & Forfeiture of shares, Purchase of Business, Liquidation, Valuation of share, Amalgamation, Absorption and Reconstruction. Holding Company Accounts. Accounting Standards in India, Inflation Accounting, Human Resource Accounting, Social Accounting.

(ii) Principles of Auditing, Types of Audit, Audit Procedures. Duties of Auditor, Company Audit.

(iii) Cost and Management Accounting Principles, Ratio Analysis, Funds Flow Analysis- Cash Flow Analysis- Marginal Costing and Break-Even analysis- Standard Costing, Budgetary control, Costing for decision-making - Responsibility Accounting.

C. Business Laws, Insurance and Transport :

(i) Legal Environment of Business in India, Competition policy, Consumer protection, Environment Protection. Indian Contract Act, Basic provision under Company Law, Sale of Goods Act. Basics of Income Tax Act : definitions, Tax Incidence, Exempted Incomes, Computation of taxable income under various heads : Individuals and firms, Deduction of Tax, filing of Returns, different types of assessment, Defaults and Penalties. - Tax planning : Concept & methods, significance (Theory and Problems), Tax evasion and Tax avoidance, Tax planning.

(ii) Principles of Insurance, Types of insurance, Privatization of Insurance in India. Features of IRDA.

(iii) Transport System in India. Types of transports : Relative merits and demerits, Introduction to Transport Economics. Role of Transport in Indian economic growth.

D. Business Economics, Banking & Finance, Co-operation and Rural Development:

(i) Nature of Business Economics, Concepts of Profit & Wealth maximization, Demand Analysis and Elasticity of Demand, Indifference Curve Analysis. Utility Analysis, Different Laws of Return. Cost, Revenue, Price determination in different market situations: Perfect competition, Monopolistic competition, Monopoly, Price discrimination and Oligopoly, Pricing strategies.

(ii) Banking Structure in India, Challenges of Liberal economic policies and banks and financial Institutions. Money and Capital markets, Working of Stock Exchanges in India, NSE, OTCE, NASDAQ, Derivatives & Options, Factoring, Measurement of risks and returns, Securities and portfolios.

(iii) Principles of Co-operation, Role of Co-operation in Economic development, Future of Co-operation in liberalized global economy – Financial Inclusion – Government initiatives for Rural Development : Policies and problems.

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The following instructions shall be issued to the examiners and examinees in respect of Paper II

(a) The Paper II shall be of 2 hours duration carrying 100 marks, divided into Two Sections as given below :

Section I (First) : will carry 20 marks consisting of 20 objective type multiple choice questions of 1 mark each.

These questions will be based on the entire syllabus covering 'A' to 'D' groups.

Section II (Second) : will carry 80 marks consisting of 4 questions of 20 marks each. Under this Section a candidate has to opt for any one of the following subject groups :

Group A : Business Administration, Business Practices Marketing

Group B : Advanced Accounting & Auditing, Advanced Cost & Works Accounting

Group C : Business Laws, Insurance & Transport

Group D : Business Economics, Banking & Finance Co-operation & Rural development

(b) There will be no negative marking for this Examination

(c) The candidates will be allowed to write answers to the questions under Section II (Second) in English or Marathi. However the Question Paper will be set in English only.

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Sub : Scheme for Pre-Ph.D Entrance Examination in Commerce.

The Pre-Ph.D. entrance examination in Commerce shall be held in the month of December 2009.

The syllabus of the examination is enclosed with this note (flag A)

The Paper shall be of 100 marks.

It will be divided in two parts. i.e. 20 marks objectives & 80 mark theory.

The Paper shall be divided in 4(four) groups. A student shall have to option.

One group out of the four.

The groups are as follows :

The objective questions shall be on the entire syllabus of Commerce covering all the four groups. There will be multiple choice questions with 4(four options) for each question.

For each optional group there will be 4 questions of 20 marks each.

The candidate has to answer all the 4 questions. There will be no internal option in the group.

The examination will be of 2 hours duration.

There will be no negative marks for the objective questions.

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Note regarding evaluation Pattern of Pre-Ph.D. entrance examination Paper & Personal interview of the candidates.

Every candidate divisions to en roll for Ph.D. will have to appear for a written test. The structure of question paper for written test shall be as follows.

Duration	2 hours.
Total marks	100 marks
Long answer questions	80 marks
Objective questions	20 marks

There shall be 4 group of long answer questions.

Each group shall have 4 questions of 20 marks

There will not be internal option in any group.

The objective questions will be 20 (twenty) in number with 4 multiple options. Each question shall carry one mark.

The performance of written test be will be ranked in the order of merit.

The interview :

The candidates who have appeared for written test shall also have to appear for personal interview. The personal interview shall have 50 marks. The division of the 50 marks is as follows.

- Personality 10 marks
- Subject knowledge 10 marks
- Communication Skills 10 marks
- Awareness 10 marks
- Analytical approach 10 marks

The interview shall be conducted by an committee of experts.

The constitution of committee shall be as follows.

Dean, Faculty of Commerce & Chairman,

Two Subject experts from the faculty

One Faculty member of the Department

Head of the Department, as Secretary

Representative of B.C. Cell

The merit list of the candidate shall be made on the basis of personal interview .The marking of the personal interview shall be as follows :

Sr. No	Name of the Candidate	Personality (10)	Subject knowledge (10)	Communication Skills (10)	Awareness (10)	Analytical approach (10)	Marks in P.I. (50)	Rank

The rules regarding reservation of seats as per Government norms shall be followed while ranks the candidates. These shall be 50% seats reserved for B.C. category candidates.

The Candidates who have passed NET/SET& M.Phil [before 30 June 2009 as per UGC Notification] examination shall have to appear for personal interview only.

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Syllabus for Ph.D. in Law Entrance Examination (2010)

LW-101- Constitutional and Legal Order-I

Objectives :

To give comprehensive idea of the juristic basis, scope and content of each Fundamental Right as enshrined in the Indian Constitution, the limitations placed on the right, and an evaluation of the manner in which the judiciary has attempted to establish a balance between Fundamental Rights and State Control.

Importance of directive principles of State Policy as lying down the perspective for the preferred values of the society, and their relationship to Fundamental Rights, need to be studied.

To critically study the value system emanating from the fundamental rights in the social context of their functioning. A comparison with value systems as found in the respective Constitutions of Canada, Australia, U. K., USA and South Africa in this area is to be studied.

To study the center-State relations in India in all their aspects, along with the conflicts they have generated and the possible solutions.

Since the contents and the limits of the above provisions have essentially been worked out through the decisions of superior courts, the emphasis would be on the analysis and evaluation of the leading decisions and other materials in the context of social needs, and the extent to which our policy has succeeded in balancing the various conflicting interests.

1) Constitutional Law of India :

a) Main objects of Indian Constitutional Law. Preamble.
b) Significance of Preamble : Judicial Review of provisions of constitution.
c) Important features of Indian Constitutional Law.
d) Comparison of Indian Constitution with other major constitutions.

2) Entrenched Bill of Rights : (Part III of Indian Constitution) :

a) Parliament's Power of limit application of Fundamental Rights.
b) Amend ability of Fundamental Rights. Basic features doctrine.
c) Relationship between Fundamental Rights and Directive Principles of State Policy.

3) Enforceability of Fundamental Rights :

a) Significance of the Article 12.
b) Scope and concept of 'State under Article 12.
c) Whether any other authorities include public authorities like

d) Functional analysis of definition of 'State'.

4) Definition and nature of Law under Part III of Indian Constitution :

a) Inter relationship between Art. 12 (1) and Art. 13 (2)
b) Whether Personal Laws are covered by phrases 'Existing Laws' and 'Laws in Force'.
c) Doctrine of Eclipse.
d) Whether the doctrine is applicable to post Constitutional legislations?
e) Whether Law under Article 13 covers amendment in the light of doctrine of basic structure ?
f) Doctrine of severability and waiver.

5) I) Right to Equality :

a) Fundamental Principles of Equality (Art. 14)
b) Classical view of equality (Doctrine of reasonable classification)
c) Modern view of equality (Equality as absence of arbitrariness)
d) Interrelationship of Article 14 with Articles 15 and 16.

II) Safeguard against Discrimination in Public Life :

a) Need for definition of discrimination.
b) Affirmative action in favour of women, children, educationally and socially backward classes and SCs, STs [Article 15 (3) and 15 (4)

III) Combating Discrimination in Public Employment : (Article 16)

a) Reservation in appointment and posts in favour of backward classes .... distinction between Art. 15(4) and 16 (4)
b) Judicial interpretations of Articles 15 and 16.
c) Pre Mandal Era.
d) Mandal Commission case.
e) Post Mandal scenario.
f) Determination of Criteria for backward classes.
g) Doctrine of creamy Layer.
h) Kalelkar Commission and Mandal Commission.

6) Fundamental Freedoms : Art 19)

a) Availability of fundamental freedoms under Article 19 to Citizens only.
b) Can legal persons enjoy protection under Article 19?
c) Freedom of speech and expression.
d) Purview of term "Speech and Expression".
   - Freedom of press.
   - Freedom of broadcasters and electronic media.
   - Article 19 and use of Internet.

- Commercial speech.
- Right to know.
- Right to silence.
- Books and Cinemas etc.

e) Extent of restriction.
- Reasonable restriction.
- State censorship.
- Doctrine of prior restraint, other reasonable restrictions.
- Judicial Review.

f) Freedoms under Article 19(1)(b) to (g).

7) Right to life and Personal Liberty (Art 21) :

(i) a) Principle of due process of Law : A comparative perspective.
b) Judicial interpretation of the term 'Life and Liberty'
c) Protection of third generation rights (Group Rights, rights of prisoners, rights of children, rights of workers, rights of women, rights of refugees, (Adivasis etc)
d) Protection under Article 21 to foreigners.
e) Article 21 and right to human dignity.
f) Rape as violation of Article 21.
g) Compensation for violation of Article 21.
h) Right to education Art. 21-A.

ii) Preventive detention and fundamental rights (Article 22).

iii) Safeguard against abuse of criminal law (Article 20)
a) Freedom against self-incrimination.
b) Protection against double jeopardy.
c) Protection against retrospective operation of criminal law.

8. A) Freedom of religion : (Art. 25)
- Religious freedom for every person.
- Freedom of conscience and freedom to profess, preach and practice religion.
- Protection if confined to essential tenet of the religion.

B) Protection of freedom of Religious Denominations (Art 26) :
- Nature of religious denominations.
- Limited protection.
- Absence of protection to secular activities.
- Scope of State's power to introduce social welfare and reforms in different religious.

C) Scope of Article 27 and Article 28.

D) Conversion and freedom of religion.

9. Cultural and Educational Rights of Minorities :

a) Criterion to determine the status of Minority State wise or in accordance with whole of India.
b) Meaning of term culture.
c) Right to establish educational institution of minority (Art. 30)
d) Judicial Review.

10. Right to enforce fundamental rights : (Constitutional remedies) under Article 32 & 226.

- Interrelationship between article 32 and 226.
- Writ jurisdiction of Supreme Court and High Courts writs.
- Nature and application of the writs.
- Public interest litigation, conditions to resort to the litigation.
- Judicial attitude towards the litigation.
- Significant and recent precedents.

LW-102 : Legal Theory and Feminist Jurisprudence-I

Objectives :

To give a clear understanding of scope, nature and function of Law. An understanding of nature and working of authoritative sources of law in development of legal system.

An analysis of legal concepts in context of social development and changing economic and political attitude.

And an appreciation of the purpose of law, and relationship to ethics and justice. (The course aims developing and insight into the juristic foundations of a legal system-an understanding of the law as it exists and functions in society.

Topics :

1.Nature Law theories :

a) Classical era of Natural Law.
   ST Thomas Acquainas.
   Grotious.
   Hobbes.
   Locke.
   Rousseau.
b) German Transcendental Idealism-Kant.
c) Revival of Natural Law.
   - Stammler.
   - Fuller
   - John Finnis.
d) Semi-sociological natural Law – Prof. H.L.A. Hart.

2. Legal positivism :

a) Austin's analytical theory of Law.

b) Pure Theory of Law-Hans Kelson.
c) H.L.A. Hart's concept of Law.

3. Historical school of Law – Sir Henry Maine-Savigny.

4. Sociological Jurisprudence :

a) Prof. Pound-Social Engineering Theory.
b) Prof. Patterson.
c) Prof. Selznick.

5. American legal Realism:

a) Jerome Frank.
b) Karl Lewellyn.
c) Indian Judicial process & relevance to American legal realism.

LW-103 : Law, Social Transformation and Judicial Process in India-I

Objectives of the Course :

The course is designed to offer the teacher and taught with :

1. Awareness of Indian approaches to social, economical and political problems in the context of Law as a means of social control and change.
2. Spirit of inquiry to explore and exploit law and legal institutions as a means to achieve development within the framework of law.
3. To spell out and assess the role and task of the legislature in contemporary Indian in the context of the State ideals of secularism, democracy and socialism.
4. To identify role of Law in contemporary Indian society as a tool of empowerment of the disadvantaged sections of society its achievement, failures and limitations.
5. To explain the principles, goals and objectives of legislative formulations.
6. To spell out various factors involved in and responsible for legislative formulations.
7. To point out and explain effectiveness of legislation and a State-tool for shaping society and peoples life in modern societies. To understand the legislative trends and policy in present context.

Note : In light of the objectives of the course the students shall be in a position to critically and analytically evaluate legislative actions, identifying its importance and forces. Examine the specific problem from the socio-legal perspective and suggest suitable amendments in current law to make law more effective and meaningful.

Topics for Study :

1. Law and social change (achievements and failures)

1.1 Law as an instrument of social change.

1.2 Law as the product of traditions and culture, Criticism and evaluation in the light of colonization.

1.3 Justice-socio-economic and political, equality freedoms, individualism and collectivism as foundation of Law making in India.

1.4 Law making in the area of fundamental duties, Part IV A and Directive Principles of State Policy Part IV.

2. Use of Law by State to control and regulate people in modern democracies and autocracies, with special reference to Indian Democracy and its contemporary trend.

3. Process of Legislative Law making (jurisprudential analysis) problems and perspective in formulation of legislative law in the contemporary context.

4. Relationship between following concepts and their influence on social behaviour and their challenges to law.

1. Law and Development.
2. Law and Public opinion-correlation between public opinion and legislative formulation and implementation.
   a) Religion as a divisive factor.
   b) Secularism as a solution to the problem.
   c) Reform of law on secular lines : Problems.
   d) Freedom of religion and non-discrimination on the basis of religion.
   e) Religious minorities and the law.

5. Law and disadvantage : Sections of Society Women, children, Backward classes and minority. Study of protective and empowerment measures under the Constitutional and Statutory Laws.

a) Caste as a divisive factor.
b) Non-discrimination on the ground of caste.
c) Acceptance of caste as a factor to undo past injustices.
d) Protective discrimination : Scheduled castes, tribes and backward classes.

6. Regionalism and the law :

a) Regionalism as a divisive factor.
b) Concept of India as one unit.
c) Right of movement, residence and business; impermissibility of state or regional barriers.
d) Equality in matters of employment : the slogan "Sons of the Soil" and its practice.
e) Admission to educational institutions : preference to residents of state.

7. Education, Media and the Law.

8. Economic, Political structure and the Law, Parliamentary democratic cooperative Federalism.

9. Democratic decentralization and local self-government, Panchayat system.

Law-104 : Research Methods and Legal Education-I

Objectives:

The main objective of this course is to acquaint the student of law with the scientific method of social science research. This course is expected to provide the minimum knowledge of the technique of selection, collection and interpretation of primary and secondary data in socio-legal research. Emphasis would be laid on practical training will be imparted through regular workshop for which one hour per week will be reserved.

A) Legal Education and the modern multi and trans-disciplinary approaches

1. Objectives of legal education.
2. Lecture method of teaching-Merits and demerits, communication skills.
3. The problem method.
4. Discussion method ad its suitability at postgraduate level teaching.
5. The seminar method of teaching.
6. Examination system and problems in evaluation-external and internal assessment.
7. Student participation in law school programmes Organization of Seminars, publication of journal and assessment of teachers/Out come of the seminars and the implementation of reports of various seminars symposia, workshops.
8. Clinical legal education-legal aid, legal literacy, legal survey and law reform.
9. Curriculum Reform and Teaching Methods in various areas of law.
10. Post graduate Teaching and Research.
11. Teachers training, facilities etc for research.
12. Assessment of student's skills to be taught/use of Library in research.
13. Language and the Law :-
    a) Language as a divisive factor: formation and linguistic states.
    b) Constitutional guarantees to linguistic minorities.
    c) Language policy and the Constitution, official language: with language system.
    d) Non-discrimination on ground of language.
14. Alternative approaches to Law. Role of social scientists, social change and social reformers.
    a) Jurisprudence of sarvodaya Gandhiji, Vinobha Bhave, Jayprakash Narayan, and surrender of dacoits, Naxalite movement: cause and cure concepts of gram Nyayalayas.
    b) Indian Marxist critique of law and justice.

B) Research in Law:-

1. The science of research and scientific methodology (theory, facts, definition and concepts, variables etc. i.e. characteristics of scientific methodology).

2. Application of scientific method to the study of Socio-legal phenomena-limitations and difficulties.
3. Socio-legal research and Legal research models.
4. Doctrinal and non-doctrinal research.
5. Relevance and Significance of empirical research.
6. What is a research problem? Formulation of research problem.
7. Survey of available literature and bibliographical research.
8. Legislative material including subordinate legislation, notification and policy statements.

LW-201 : Constitutional and Legal Order II

Objectives:-

To give comprehensive idea of the juristic basis, scope and content of each Fundamental Rights as enshrined in the Indian Constitution, the limitations planed on the right, and an evaluation of the manner in which the judiciary has attempted to establish a balance between Fundamental Rights and State control.

Importance of directive principles of State Policy as laying down the perspective for the preferred values of the society, and their relationship to Fundamental Rights would also be studied.

To critically study the value system emanating from the fundamental Rights in the social context of the functioning. A comparison with value systems as found in the respective Constitutions of Canada, Australia, U.K., USA, and South Africa in this area to be studied.

To study the Center-State relations in India in all their aspects, the conflict they have generated and the possible solutions.

Since the contents and the limits of the above provision have essentially been worked out through the decisions of superior courts evaluation of the leading decisions and other materials in the context of social needs, and the extent to which our policy has succeeded in balancing the various conflicting interests.

Topics

1. Federalism:

- What is a federal Govt.?
- Conditions for federation.
- Patterns of federal govt. – USA, Australia, Canada, India.
- Application of principle of federalism in India.
- Division of powers between Center and State.
- Residuary power compare with USA
- New trends in federalism – cooperative federalism
- India – Central control versus State autonomy
- Political factors influencing federalism.
- Impact of coalition Govt. in Center on federalism in India.
- Implications of panchayat Raj for federalism.
- Comparison between parliamentary and federal systems.

2. Legislative Relation:-

- Distribution of legislative powers-the three lists.
- Other constitutional sources of legislative powers.
- Principles of interpretation of the lists. Doctrines of pith and substance. Colorable legislation, sever ability.
- Residuary legislative power of Center.
- Flexible Center-State legislative Relations.
- Repugnancy between Central and State laws Constitutional and Judicial Principles.
- Situations when parliament can legislate on matter reserved for the States.
- Legislative implication of emergency on distribution of legislative powers.

  Presidents veto in legislative matters.
- President's legislative power.
- Governor's legislative powers.

3. Financial Relationship:

- Scheme of allocation of taxing powers.
- Restrictions on the taxing powers.
- Distribution of tax revenues.

  (I) Tax sharing and fiscal need grants.

  (II) Finance commission

  (III) Specific purpose grants (Art. 282)

Inter governmental tax immunities. Areas of stress and strain in federal financial Relations.

4. Relationship in the scheme of planning and development Planning: its need and Objects.

- Its constitutional and administrative basis.
- Planning commission and finance.
- Financial assistance in planning.

5. Relationship in trade and commerce.

- Centre's power to regulate trade and commerce.
- State's power to regulate trade and commerce.
- Extent of freedom of trade, commerce and intercourse.
- Disputes relating to inter State trade and commerce (art 307)
- Sarkaria commissions report on Center State relations and

6. Emergency powers under constitution of India.

- Article 352 -360

-Judicial review if declaration of emergency with special reference to Art. 356

- Nature and scope of Art. 355
- Inter relationship between articles 355 and 356.

7. Judiciary:

(A) Hierarchy of Courts in India.

(B) Supreme Court of India.

- Qualifications, disqualifications for the appointment of Judges.
- Appointment of Chief Justice of India.
- Supreme Court ruling on Procedure for appointment of Judges.
- Powers of Supreme Court.
- Power to supervise other Courts and tribunals etc.

Jurisdiction of Courts :

(1) Original

(2) Appellate

(3) Advisory

High Courts :

- Constitution of High Courts.
- Procedure for appointment of High court Judges.
- Qualifications and disqualifications of High court Judges.
- Powers of High Courts.

* Power of Superintendence
* Power to withdraw cases to itself.
* Control over subordinate Courts.

- Jurisdiction of High courts: Original and appellate
- Controversies surrounding Transfer of Judges of High Courts.
- Procedure for impeachment of Judges of Supreme Court and High Courts.
- Doctrine of independence of Judiciary.
- Judicial activism and its confrontation with legislature and Executive.
- National Judicial Commission.

8. Process of electioneering in India:-

a) Constitutional foundation of election commission.
b) Composition of election commission.
c) Powers and functions of election commission.
d) Need for reforms in electioneering.
e) Right to know credentials of contestants elections.

9. Governors:-

a) Appointment of Governor
b) Powers and functions of governors.
c) Qualifications and disqualification of governor
d) Problem of Politicization of post of Governor
e) Role of Governor in imposition of Presidents rule in State.

10. Anti-defection law and Parliamentary privileges.

LW-202: Legal Theory & Feminist Jurisprudence Syllabus – II Semester

Objectives:

The Objective of this study is to give a clean understanding of the nature, scope and function of Law. The study of any legal system at postgraduate level necessitates its basic foundations to enable students to acquaint with the nature of legal system and its role in the development of society.

An analysis of legal concepts in the context of society development and changing socio-economic and politics attitude and an appreciation of the purpose of Law and its relationship to ethics and Justice. This course aims at developing a insight into the jurist foundation of a legal system and understanding of Law as it exists in a given contemporary society.

The nature and foundation of Law has undergone changes in the recent past, the current trends and developments are essentially to be studied in the context of justice viz. gender, social and economic along with new challenges and its responses.

Topics:

1. Doctrine of precedent:

- Nature and scope.
- Authority of precednt.
- Bindingness of precedent.
-Precedent in British legal system.
-Ratio decidenti-obiterdicta.
-Theories of ratio decidenti..
-Art 141 of the Indian Constitution.
-Doctrine of Prospective overruling.
-Advisory Jurisdiction and precedent.

2. Concept of Legal Right :

- Nature and definitions.
-Theories of Rights.
-Fundamental legal conceptions of Right (Hohfeldian Analysis).
-Kind of Rights.

3. Feminist Jurisprudence :

-Nature and Types of Feminism.
-Gender justice and feminism.
-Indian Constitution of Feminist Jurisprudence.

4. Rawls Theory of Justice :

- Notion of Justice.
-Distributive Justice.
-Applicability of Rawls Theory to Indian Legal system.

5. Law and Enforcement of Morals :

-Basis and nature of morality.

-Role of morality.
-Morality and Indian Legal system.

LW-203 : Law, social Transformation and Judicial Process in India- II

Objectives of the Course :

A lawyer, whether academic or professional, is expected to be competent to analyse and evaluate the legal process from a broader juristic perspective. Hence a compulsory paper on Judicial Process is essential in the LL.M. curriculum. The objective of this paper is to study the nature of judicial process as an instrument of social ordering. It is intended to highlight the role of court as policy maker, participant in the power process and as an instrument of social change. This paper further intends to expose the intricacies of judicial creativity and the judicial tools and techniques employed in the process.

since the ultimate aim of any legal process or system is pursuit of justice, a systematic study of the concept justice and its various theoretical foundations are required.

Topics for Study

The following syllabus prepared with the above perspective will spread over a period of one semester.

1. ***Nature and scope of judicial process:***
    a) Judicial process as an instrument of social ordering.
    b) Judicial process and creativity in law-common law model-Legal Reasoning and growth of law-change and stability.
    c) The tools and techniques of judicial creativity and precedent.
    d) Legal development and creativity through legal reasoning under statutory and codified systems.

2. Special Dimensions of Judicial Process in Constitutional Adjudications:

a) Notions of judicial review.
b) 'Role' in constitutional adjudication-various theories of judicial role.
c) Tools and techniques in policy-making and creativity in constitutional adjudication.
d) Variants of judicial and juristic activism.
e) Problems of accountability and judicial law-making.

3. Judicial Process in India:

a) Indian debate on the role of judges and on the notion of judicial review.
b) The "Independence" of judiciary and the "political" nature of judicial process, National Judicial Commission-role and purpose.
c) Judicial activism and creativity of the Supreme Court-the tools and techniques of creativity.
d) Judicial process in pursuit of constitutional goals and values-new dimensions of judicial activism and structural challenges.
e) Institutional liability of courts and judicial activism-scope and limits.

4. The Concept of justice:-

a) The Concept of justice or Dharma in Indian thought.
b) Dharma as the foundation of legal ordering in Indian thought.
c) The concept and various theories of justice in the western thought.
d) Various theoretical bases of justice: the liberal contractual tradition, the liberal utilitarian tradition and the liberal oral tradition.

5. Relation between law and Justice:

a) Equivalence Theories-Justice as nothing more that the positive law of the stronger class.
b) Dependency theories-for its realization justice depends on law, but justice is not the same as law.
c) The independence of justice theories-means to end relationship of law and justice- The relationship in the context of the Indian constitutional ordering.
d) Analysis of selected cases of the Supreme Court where the judicial process can be seen as influenced by theories of justice.

6. Relationship between judiciary and other organs of State:

***7. Need of judicial restraint (judicial activism vis-a-vis judicial restraint) Exclusion of judicial review under the Constitution, Statute and self*-imposed rules of judicial restraint.**

8. Reform of Court Processes:

Civil law : (ADR):

a) Confrontation v. consensus.
b) Mediation and conciliation.
c) Lok Adalats.

LW-204: Research Methodology and Legal Education II

A) Identification of Problem of research:

1. Decisional material including foreign decisions; methods of discovering the 'role of the case', tracing the history of important cases and ensuring that these have not been over-ruled; discovering judicial conflict in the area pertaining to the research problem and the reasons thereof. Identifying the ratio/principle having binding character.
2. Juristic writing-a survey of juristic literature relevant to selected problems in India and foreign periodicals.
3. Compilation of list of reports or special studies conducted and related to the problem.

B) Preparation of research design:

1. Hypothesis: its role, definition, criteria of a workable hypothesis and its sources.

2. Major steps of preparation of research design.
3. Devising tools and techniques for collection of statutory and case materials and juristic literature.
4. Methods for the collection of statutory and case materials and juristic literature
5. Use of historical and comparative research materials.
6. Research tools: Observation, Interview, Questionnaire (Utility and limitations and methods of using these tools).
7. Use of case studies and surveys.
8. Sampling techniques:
   a) Design of sample
   b) Its uses and advantages in research.
   c) Random sampling, simple random, stratified random, systematic random.
   d) Non random sampling, haphazard, availability and purposive etc.
9. Scaling Techniques-Types, utility, modus operandi (a) Elementary statistics, design and stages in statistical investigation and interpretation and Preparing Diagrams and graphs.
10. Introduction and deduction.
11. Content analysis.
12. Data collection, Data processing and analysis and interpretation of data.
13. Classification and tabulation of data-use of cards for data collection-rules for tabulation. Explanation of tabulated data.
14. Jurimetrics and socio-metrics.
15. Computerized research-a study of legal research programmes such as Lexis and west law coding.
16. Research report (Report writing) Citation rules and modes of legal writing. (tie-up with industries, colleges, student welfare, NSS, NCC, Legal literacy and training programme etc)

SYLLABUS FOR PHD ENTRANCE EXAM.
IN
ANTHROPOLOGY
(Paper 2)

SOCIAL & CULTURAL ANTHROPOLOGY

- Introduction
- Concepts of Culture, Society & Civilization
- Configuration of Culture
- Social Organization: Family, Marriage, Kinship
- Economic Organization
- Political Organization
- Religious Organization

INDIAN SOCIETY AND CULTURE

- India in perspective
- The Orthodox Pattern: Vedas, Brahmanas, Jainism, Buddhism, and Charvaka.
- The Hindu synthesis
- Caste system
- Indian Family, Marriage and Kinship
- Social Stratification in India
- India's Social Transformation

BIOLOGICAL ANTHROPOLOGY

- Introduction, Nature and Scope of Biological Anthropology
- Theories of Evolution
- Biological Basis of Life and Heredity and Evolution
- Concepts in Modern Evolutionary Theory
- Trends in Human Evolution
- Human Variation
- Concepts of Race and Racism

CLASSICAL ANTHROPOLOGICAL THEORIES

- Evolutionism
- Diffusionism
- Historical Particularism

- Cultural Materialism
- Historical Materialism
- Structure-functionalism
- Structuralism
- Parsonian ideas of social-cultural system;
- Culture-Personality Margaret Mead;
- Pattern-Configuration: Ruth Benedict;
- Culture Interpretations: Clifford Geertz;
- Social Anthropology as an approach: Evans-Prichard

ARCHEOLOGICAL ANTHROPOLOGY

- Introduction to Archaeology
- Dating Methods, Tool Typology and Technology
- Paleolithic Cultures
- Mesolithic and Neolithic Cultures
- Indus valley civilization, Chalcolithic and Megalithic Cultures

SOCIAL SCIENCE RESEARCH METHODOLOGY

- Science and Scientific Research
- Scientific Social Research
- Research Design
- Survey Method and Sampling Techniques
- Quantitative Analysis: Basic Statistics
- Basics of Qualitative Analyses
- Ethnography: Fieldwork Tradition in Anthropology and Current Approaches

ADVANCED ANTHROPOLOGICAL THEORIES

- Post Modernism
- Systems Theory
- Dialectical Anthropology
- Symbolic Anthropology
- Ethnomethodology
- Ecological Anthropology
- Sociobiology
- Psychological Anthropology

MEDICAL ANTHROPOLOGY

- Socio cultural aspects of medicine
- Human adaptation : complex interactions between environmental factors and illness
- Theoretical Perspectives in Medical Anthropology Models
- Ethno medicine, Medical Pluralism
- Cultural Epidemiology
- Concept of public health
- Determinants of Health

- Health Problems and Health Programmes
- Health Policy and Planning
- Gender and Reproductive Health

HUMAN BIOLOGICAL VARIATION AND POPULATION GENETICS

- Population Genetics
- Methods in Population Genetics and Genetic polymorphism
- Genetic Markers in Human populations: Classical Markers
- Haemoglobin- Normal and Variant forms
- Plasma Proteins
- Molecular Markers
- Consanguinity

TRIBAL AND RURAL DEVELOPMENT

- The Weaker Sections of Indian Population
- Tribal Problems, Movements and revolts
- Approaches to Tribal Development
- Administration of Tribal Development
- Sectors of Tribal and Rural Development
- Panchayat Raj Act and the Self Rule
- Development Issues

GROWTH DEVELOPMENT AND NUTRITION

- Human Growth and Development
- Factors Influencing Growth
- Nutrition
- Special Problems Related to Growth and Nutrition.
- Abnormal Growth.
- Determinants of Nutritional Levels, and Nutrition Education

DEVELOPMENT ANTHROPOLOGY AND URBAN ANTHROPOLOGY

- Definition, scope, subject matter,
- Paradigm of Modernization
- Critique of Dependency, Paradigm of Multiplicity
- Agencies of Development
- Development Planning and Communication
- Urban Anthropology, Folk – urban Continuum
- Anthropology of Urbanization
- Role of cities in cultural transformation
- Methodological Contribution
- Ethnicity and Pluralism
- Anthropological Approaches to urban planning

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SYLLABUS: Ph.D ENTRANCE TEST -- PAPER II
DEFENCE AND STRATEGIC STUDIES

Pattern of the Question paper

1. **Paper II will be of 100 marks. The examination will be of 2 hours duration.**
2. **Section I will have 20 objective type questions covering the entire syllabus. All questions will be compulsory. (Total Marks 20)**
3. **Section II will have questions covering all the eight areas of the subject mentioned in the syllabus. Students will have to answer ONE question from each of the areas (internal choice would be provided). Each question will be of 10 marks. Word limit for each answer is 150 words. (Total Marks 80)**

1. Strategic Studies

a. Strategic Studies: Assumptions and Approaches
b. Theories and Causes of War – Nature of Contemporary Warfare
c. Deterrence: Concept, Nuclear Deterrence and Current Relevance.
d. Nuclear Strategy: Early Debates on the relevance of Nuclear Weapons. - US Nuclear Strategy - Soviet Nuclear Strategy - Russian Nuclear Strategy/Policy making - Chinese Nuclear Strategy - Indian Nuclear Strategy - Pakistan's Nuclear Strategy
e. Strategic Studies in the post cold war era.

2. Geo-Politics and Military Geography

a. Scope and Importance of geopolitics
b. Evolution of Geopolitical Thought since the 19th Century - Geopolitics during the Cold War Period - Geopolitics in the post cold war era.
c. Role of Geography in Military applications
d. Man and Environment : (a) determinism, (b) Positivism
e. Important and Scope of Logistics
f. Planning Process and Principles of Strategic Geography
g. Role of Geography in Land Warfare, Sea Warfare, Air Warfare and Space Warfare
h. Weather conditions of Sea as factors in amphibious and airborne operations
i. Military Geography of India and Defence Problems

3. International Relations

1. Theories and Approaches
2. Cold war –Détente – New Cold War -1989 changes in East Europe, Soviet disintegration.
3. Developments in the Third World: Regionalism, and Nonalignment
4. Evolution of International Economic Issues: Breton Woods System; NIEO; North-South; GATT and WTO.
5. New World Order and Globalisation.

4. National Security

a. Key Concepts of Security: (a) Balance of Power, (b) Collective Security, (c) Neutrality, (d) Nonalignment, (e) Equal Security, (f) Common Security.
b. Approaches to Peace: (a) Diplomacy, (b) International Law, (c) United Nations, (d) Arms Control and Disarmament. (e) Track II diplomacy
c. Problems of India's Security: - Global, Regional and Local environment and its impact on Security thinking.
d. Problems of India's Internal Security and the Role of the State (Political, economic, socio-cultural and other dimensions, Terrorism, insurgency, etc.)
e. Defence Organization of India
    a. Higher Defence Organisation in India
    b. Ministry of Defence
    c. Paramilitary Forces
    d. Intelligence Agencies
    e. Kargil Review Committee Recommendations
f. India and Neighbours
g. India and the United States (post 1990-91)
h. India and Russia (post 1990-91)
i. India and the Asia Pacific (post 1990-91)
j. India and Europe (post 1990-91).
k. India and West Asia (post 1990-91)
l. SAARC

5. Indian Military History

a. Military History of Ancient India
b. Military History of the Medieval India
c. The Military History of the Marathas
d. The other regional military traditions of the Medieval period in India
e. The British Period: The Making of the British Military forces - The Command Structure of the British (Company's) Army - The British Military Operations in the 19th century:
f. British Indian Army
g. Indian National Army.

6. Peace and Conflict Studies

a. Conceptual analysis of Conflict and Peace
b. Conflict Management and Conflict Resolution
c. UN System : Pacific Settlement of Disputes - Peace Keeping, Peace making and Adjudication
d. Disarmament and Arms Control
e. Confidence Building Measures
f. Functional Approaches and Regionalism
g. Gandhian Approach and its relevance today
h. Comprehensive Security and Human Security
i. Peace Research and Peace Movements

7. Defence Economics

a. Economic Theories of Defence
b. Determinants of Defence/Security Expenditure
c. Framework for analysis of India's Security Expenditures
d. India's Defence Budget
e. Defence and Development
f. Rationale of Arms production
g. Defence production in India
h. Economic Instruments of Policy
i. An analysis of India's security expenditures since 1947.

8. Science, Technology and National Security

a. Introduction to Military Technology - its relevance to National Security.
b. Introduction to emerging technologies.

(a) Energy
(b) Electronics, Computers, nanotech and Artificial Intelligence.
(c) Material Science.
(d) Biotechnology.
(e) Communications and Information Technology.
(f) Transportation and vehicle technology.

c. Application of technologies to:-

(a) Armament and Weapon systems.
(b) Missile Technology.
(c) Communications and Radar technology.
(d) Electronic Warfare and Information Warfare.
(e) RNBC Warfare and Nuclear Energy.
(f) Aircraft and Ships.
(g) Satellite and Space technology.
(h) Intelligence.
(j) Logistics (transport, supplies, inventory, medical, repair, clothing and equipment).
(k) Border Management.

d. Impact of developing technologies on Military Doctrine and conduct of warfare.
e. Application of new technologies for Internal Security, Disaster Management, Training and Administration.
f. Non military use of modern technologies and their impact on National Security (Power and energy, Trade, Economy, Banking, Media etc).

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Department of Library & Information Science,
University of Pune, Pune

Syllabus for Ph.D. Entrance test

Unit I

Intellectual Property Rights-Concept, Copyright, Censorship-Print and Non-print Media.
Library and Information Policy at the National Level
LIS Education in India
LIS Profession
Library & Information services
Role of UGC in the growth and development of libraries and information centres in institutions of higher education in India
Information Literacy

Unit II

Vocabulary Control-Thesaurus, Lists of Subject Headings
Databases-Search Strategies, Boolean Operators
Knowledge Management
Information Processing & Organization
Current trends in Information Storage & Retrieval

Unit III

Financial management-Resource Generation, Cost-Benefit analysis PERT, CPM
Performance Evaluation of Libraries/Information Centres and Services
Marketing of Information product and services
Total Quality Management (TQM)
New Techniques in Library Management

Unit IV:
Impact of IT on Library
Library Networking & Networks,
Network Topologies
Hypertext, Hypermedia, Multimedia
Integrated Services Digital Network (ISDN), Open Systems Interconnection (OSI)
Digital Library
Virtual Library
Electronic Documents
Library Automation
INTERNET Components, Services, Browsing-Web Browsers, Search Engines Meta-Data, Digital Object Identifier (DOI)
Metadata, Institutional Repository, Open Source Software, Web 2.0
Current trends in IT

Unit V:
Types of Research-Basic, Applied, Interdisciplinary
Research Design
Scientific Method, Hypotheses, Data Collection, Sampling
Methods of Research-Historical, Descriptive, Case Study, Survey, Comparative and Experimental
Statistical Methods, Data Analysis
Report Writing
Research Methods in Library and Information Science and Services
Bibliometrics

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Research Ethics
Use and user study
Content analysis
Field study
Future research: Delphi Techniques
Style manuals (Chicago, APA, MLA)
Citation styles: Footnotes, references
Evaluation of research
Current trends in LIS research (Advanced countries, Less-Advanced countries and Global)

Performance evaluation and measurement

Techniques & Methods
Evaluation of Library Services & Products
SWOT Analysis
Re-Engineering of Library Services

Knowledge Management

Technology Management
Marketing Skill & Techniques
Collection development policies & procedures (By taking individual libraries i.e. needs based collection development)
Total Quality Management i.e. TQM.

Recent Management Techniques

Out sourcing
Six Sigma
Brain Storming
Mind Mapping & Other recent techniques

Networks and Security measures

Network components: UTP. Optical Fibers, Ethernet, Network Interface Card, Hub, Routers, Modems and requirement of Wi-Fi
Planning of computer networks in Library and Information Centres
Network security measures.
Internet security
Web 2.0

6. Information Literacy

Concept, need
Methods of imparting information literacy programmes
Contents of information literacy programmes
ACRL standards for information literacy
Current trends in IT

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Syllabus for Ph.D Entrance Examination
Paper II - Subject : Philosophy

1. Philosophers

Plato, Aristotle, Descartes, Hume, Kant, Mill, Wittgenstein, Russell, Moore, Sartre, Husserl

2. Indian Systems

Nyaya, Vaisesika, Samkhya, Yoga, Purva Mimamsa, Advaita Vedanta, Carvaka Buddhism, Jainism

3. Areas

a) Social and Political Philosophy – Justice, Equality, liberty, Democracy, Feminism

b) Logic and Epistemology – Knowledge, Truth, Justification, Pramanas

c) Ethics (theoretical and applied) - Deontological Theories, Teleological Theories, Issues in Bioethics, Environmental Ethics and Business ethics.

d) Metaphysics and philosophy of Religion - God, Self, Liberation, Free will and Determinism, Evil, Theories of Reality (Monism, Dualism, Realism, Pluralism)

Ph.D Entrance Test

Pattern for the Subject-Paper Philosophy

Maximum Marks: 100
Time Allowed : 2hrs

Q 1 : Attempt any 10 questions within 10 word each out of the following 13.
2 marks each, Total marks:20

Q 2 : Attempt any 2 questions out of 4. Short-note type.
10 marks each, Total marks: 20

Q 3: Attempt any 2 questions out of 4 Critical note type
is marks each, Total marks: 30

Q 4 : Attempt any 1 question out of 4.
Essay type 30 marks.

Note :

1. Q.No. 1, 2, 3 & 4 will cover approximately an equal proportion of Indian Philosophy and Western Philosophy

2. Q.No. 4 will be based on major areas of Philosophy.

Specimen Questions

Q.1 : (a) Give Vedanta definition of Brahman according to Brahmasutra.
(b) How many pramas are accepted by Nyaya? Which are they?
(c) Define JS Mill's utilitarian principle.
(d) Mention any two arguments for the existence of God.

Q.2 : Write short notes on

(a) The nature of three gunas of Prakriti according to Sankhya.
(b) Vivekananda's concept of Practical Vedanta.
(c) Discuss Hume's no self-theory.
(d) Discuss Plato's theory of ideas.

Q.3 : Write long notes on :

(a) Discuss the Gandhian concept of Satyagraha.
(b) Discuss in brief Vaisesika atomism.
(c) Discuss the Theory of Justice as Fairness
(d) Discuss critically whether animals have rights.

Q.4: Write an essay on any one of the following :

(a) The theory of Pramanas according to any two systems of Indian Philosophy.
(b) Discuss the problem of social justice with special reference to caste-system.
(c) Discuss whether freewill is compatible with the theory of karma.
(d) Discuss critically the distinction between knowledge and belief.

DEPARTMENT OF SOCIOLOGY
UNIVERSITY OF PUNE
Syllabus: Entrance Test for Research

Module 1: Concepts

1. Basic concepts: Institutions, Culture, Norms and Values, Social Structure
2. Institutions: Family and marriage, Education, Economy, Polity, Religion, Stratification – forms of stratification (Caste, Class, Gender, Ethnic)
3. Concepts related to development and globalization, dimensions of globalization, changing concept of work

Module 2: Theory

2. A.

1. Marx
2. Durkheim
3. Weber
4. Parsons

2.B.

1. Habermas and Althusar
2. Gramsci
3. Giddens
4. Foucault

Module 3: Conceptualising Indian Society

1. Theoretical Perspectives –
    - Indological/Textual Perspective: G.S.Ghurye
    - Structural – Functinoal Perspective: M.N.Srinivas
    - Marxian Perspective: A.R.Desai
    - Feminist Perspective: Leela Dube
    - Subaltern Perpective: B.R.Ambedkar
2. Development and globalization:
    - poverty – rural and urban
    - Ecological degradation, displacement
    - Health
    - Education
3. Debates: Tradition & modernity in India, Secularism

Module 4: Methods

1. Nature of Social Research – Definition, hypothesis, theory and concept , Research design
2. Quantitative and Qualitative methodology
3. Methods:
    A. Quantitative: Survey, Questionnaire, Structured interview.
    B. Qualitative: Case Study, unstructured interview, ethnography.

DEPARTMENT OF SOCIOLOGY
UNIVERSITY OF PUNE

Format of Subject Question paper for Entrance Test for Ph.D.

Section One: 20 marks

Q.1. Objective type (all modules) : (out of 13 – answer any 10)

Section Two: 80 marks

Q.2. Module I - 20 marks (out of 4 – answer any 2)

Q.3. Module II - 20 marks (out of 4 – answer any 2)

Q.4. Module III - 20 marks (out of 4 – answer any 2)

Q.5. Module IV - 20 marks (out of 4 – answer any 2)

Department of Adult, Continuing Education & Extension
University of Pune,
Pune - 411 007

Ph.D. Syllabus

Subject: Adult Continuing Education & Extension (Lifelong Learning)

Format of subject question paper for entrance test for Ph.D.- Paper II

Section One : 20 Marks

Q. 1: Objective type (all modules) out of 13 answers any 10.

Section Two : 80 Marks

Q.2: Module I. 20 marks (out of 4-answer any 2)

Q.3: Module II. 20 marks (out of 4-answer any 2)

Q.4: Module III. 20 marks (out of 4-answer any 2)

Q.5: Module IV. 20 marks (out of 4-answer any 2)

Ph.D. Syllabus

Subject : Adult, Continuing Education & Extension (Lifelong Learning)

Module 1 : Concepts and Terminologies

- Andragogy and pedagogy
- Literacy and its types - traditional, functional, mass, legal, technological
- Adult education, adult learning, continuing education
- Lifelong learning
- Development and its indicators, population education, social justice with respect of quality of life
- Extension education, field outreach, community participation
- Formal education, non-formal education, informal education, incidental learning

Module 2 : (A) Approaches to Education

l. Continuing education
2. Population education

3. Adult education
4. Non formal, Formal Education and Informal education

(B) Curriculum methods, techniques and teaching, learning materials for lifelong learning

1. Developing curricula
2. Different teaching methods
3. Teaching and learning materials for adults
4. Teaching aids - conventional, non-conventional, modern
5. Socialization and popular education as learning tools/strategies

Module 3 : Higher education and lifelong learning

- The UGC vision : committees and their recommendations, the UGC guidelines - 1978 to date
- Strategies for bringing extension, as the third dimension of the University system at par with teaching and research
- Models for extension work - monitoring, evaluation and the award of an academic credit for the extension work in the postgraduate departments and in the colleges
- Design, type, methods and implementation of extension projects.
- Impact of globalization and liberalization, characteristics/indicators for a lifelong learning
- Open learning systems - open university, extension and lifelong learning through them.

Module 4 : Research

- Action research - concept and methods
- Methods of research ; qualitative & quantitative
- Participatory research techniques
- Preparation of a research proposal
- Methods of data collection, interpretation, use of statistical methods
- Programme evaluation techniques - concurrent, summative, formative
- The research report

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University of Pune
Department of Communication and Journalism
Syllabus for Ph.D. Entrance Test

Part 1: Communication

1) Nature, process and types of communication
2) Models and theories of communication
3) Sociology of Communication, International, Political, Organistional and Marketing communication
4) Mass Media: types, evolution, role in India
5) Effects of mass media: various studies and theories
6) Traditional and folk media
7) New Media

Part 2: Research Methodology

1) Qualitative Research Methods
2) Quantitative Research Methods
3) Basic Concepts in Statistics
4) Review of literature, referencing, bibliography etc.
5) Different types of media research: print, electronic, Internet, Audience Studies etc.

Part 3: Print Journalism

1) History of the print media in India, contemporary trends, esp. in Maharashtra, well-known print journalists in the country and their work.
2) Organisational Structure and management of a newspaper office: various functionaries, their role, relationship between various departments, financial management of a newspaper
3) Role of newspapers in Indian society: political, social, cultural, etc.
4) Periodicals in India: types of periodicals, major periodicals in Marathi, Hindi and English

Part 4: Broadcast Journalism (Radio and TV)

1) Technological developments in broadcasting and their impact on broadcasting
2) Public Service broadcasting: its nature, role and responsibility in India
3) Commercial broadcasting in India: beginning, growth, impact, laws and regulations governing them
4) Broadcast programming: current trends, their impact on society

Part 5: Advertising and Public Relations

1) Relevance of advertising: economic, cultural, social

2) Contemporary Ad scenario in India: volume of advertising, various advertising media, current trends in advertising
3) Ad agency: structure, functioning, process, management
4) Public Relations: definitions, role of PR in an organisation, importance of PR professional, PR tools
5) Current trends in PR: corporate communication, CSR, event management etc.

Part 6: Media Laws and Ethics

1) Constitutional provisions regarding journalism and mass media
2) Various laws: e.g. defamation, sedition, IPR, Right to Privacy, Right to Information, censorship and self regulation
3) Mass Media Ethics: code of conduct, Sting Operations etc.

University of Pune
Department of Communication and Journalism

Pattern of Ph.D. Entrance Test Paper Total Marks 100

Part 1: Descriptive Questions Total Marks: 80

Q. 1: Essay type question Word Limit: 1000 words
Write an analytical essay on any of the three topics.
Marks: 30

Q. 2: Long answers: Word Limit: 750 words
Answer any two of the four questions. (15 marks per question)
Marks: 30

Q. 3: Short notes: Word Limit: 250 words
Answer any four of the eight questions (5 marks per note)
Marks: 20

Part 2: Objective Questions (Multiple Choice): Total Marks: 20

Q.: Answer all questions (1 mark per question.)
Marks: 20

DEPARTMENT OF HISTORY
UNIVERSITY OF PUNE

Format of Entrance Test (Subject) for research

Section One: 20 marks

Q. 1. Objective Type (all sections of the syllabus): answer all 10 of 10

Section Two: 80 marks

Q. 2. Section 1: 20 marks (out of two, answer any one)

Q. 3. Section 2: 20 marks (out of two, answer any one)

Q. 4. Section 3: 20 marks (out of two, answer any one)

Q. 5. Section 4: 20 marks (out of two, answer any one)

Syllabus: Entrance Test for Research

Section 1: Ancient Indian History (Pre-history to 800 C.E.)

i. **Sources**
ii. **Polity**
iii. **Society**
iv. **Economy**
v. **Religion**
vi. **Culture**
vii. **Urbanisation**
viii. **Recent trends and advances in research in Ancient Indian History**

Section 2: Medieval Indian History

2. A – Medieval Indian History (800 C.E. – 1800 C.E.)

i. **Sources**
ii. **Polity**
iii. **Society**
iv. **Economy**
v. **Religion**
vi. **Culture**
vii. **Urbanisation**
viii. **Recent trends and advances in research in Medieval Indian History**

2. B – History of the Marathas (1630-1818)

i. **Sources**
ii. **Polity**
iii. **Society**
iv. **Economy**
v. **Culture**
vi. **Recent trends and advances in research in Maratha History**

Section 3: Modern Indian History

3. A – India under the East India Company

i. **Administrative and Socio-economic Policies**
ii. **Education under the Company**

3. B – Colonial Period

i. **Modernity**
ii. **Education**
iii. **Society and Social Awakening**
iv. **Rise of Nationalism**
v. **Indian National Movement and Partition of India**
vi. **Press**
vii. **Economy**
viii. **Recent trends and advances in research in Modern Indian History**

3. C – Independent India

i. **The Constitution of India**
ii. **Economy**
iii. **Development of Social and Communal Consciousness**
iv. **Foreign Policy**
v. **Science and Technology**

Section 4: Theories of History and Research Methodology

4. A – Theories of History

i. **Nature and Scope**
ii. **Speculative philosophy of history**
iii. **Critical philosophy of history**
iv. **Structuralism**
v. **Deconstruction**
vi. **Postmodernism**

4. B – Research Methodology

i. **Historicism**
ii. **Historical Objectivity**
iii. **Historical Synthesis**
iv. **Heuristics and Hermeneutics**

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Political Science : Syllabus for Ph. D. Entrance Test (PET)

I Political Thinkers

1. Plato and Aristotle
2. Machiavelli
3. Hobbes – Locke – Rousseau
4. Marx and Gramsci
5. Ranade – Tilak – Nehru
6. Gandhi – Savarkar – Ambedkar – Lohia
7. Liberalism
8. Conservatism
9. Nationalism
10. Feminism

II Public Administration

1. Approaches to the study of Public Administration
2. Theories of organization
3. Financial Administration
4. Personnel Administration
5. Development Administration
6. Good Governance
7. Public Policy – models and theories
8. Actors in the Policy Process
9. Public Policy in India – Health / Education
10. Accountability of Public Administrators

III International Relations

1. Approaches to the Study of International Relations
2. Nations, Nation-state and Elements of National Power
3. Peaceful settlement of disputes
4. Arms Control and Disarmament
5. United Nations
6. Political Economy of International Relations
7. Regional – Sub – regional organizations
8. India's Foreign Policy
9. Foreign Policies of USA and China
10. Globalisation and non-state Actors

IV Comparative Politics

1. Approaches to the Study of Comparative Politics
2. Constitutionalism : theory and practice
3. Federalism and devolution of Power

4. Structures of Government – Legislature – Executive – Judiciary
5. Elections and Representation
6. Parties – Party system
7. Political elite
8. Development and underdevelopment
9. Revolution
10. Democratic and non-democratic System

V Political Sociology

1. Intellectual Foundations : Marx and Weber
2. Political Culture and Socialization
3. Power and authority
4. Ideology and Hegemony
5. State and Welfare State
6. Bureaucracy
7. Political Participation
8. Social Movements
9. Class
10. Gender

VI Politics in India

1. Nature of India's Constitution and its achievements
2. Fundamental Rights – Directive Principles
3. Federalism
4. Executive – Legislature Judiciary
5. Elections and Political Parties
6. Caste in Indian Politics
7. Regionalism
8. Politics of Secularism and Communalism
9. India's Political economy
10. Social Movements

VII Research Methodology

1. Formulation of research Problem
2. Use of Library resources
3. Aggregate Data
4. Survey method
5. Field studies
6. Research design.

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Pre Ph.D. Exam 2010 January Syllabus for Second Paper in Psychology

Chapter 1: SENSATION, ATTENTION AND PERCEPTION

1 Sensation - Introduction to psychophysics: Basic concepts and methods.
2. Attention: (a) Functions of attention: Divided attention, selective attention (b) Theories of attention process (c) Signal Detection Theory and vigilance.
3. Perception-approaches: Gestalt, Bottom-Up (feature analysis, template matching, prototypes), Top-Down and Pandemonium
4. Perception: Cross-cultural studies
5. Application: Subliminal perception, perceptual defence, and extra-sensory perception.

Chapter 2 : PROBLEM SOLVING, CREATIVITY AND DECISION MAKING

1. Problem: Definition, problem solving cycle, types, obstacles and aids
2. Problem solving approaches – Algorithm; heuristics: means-end analysis computer simulation, and analogy
3. Definition of creativity, measurement creativity
4. Reasoning and decision-making: Types of reasoning – Syllogistic and Conditional; factors influencing decision-making.
5. Application: Artificial intelligence

Chapter 3: RELIABILITY

1. Correlation coefficient: Meaning, statistical significance, reliability coefficient
2. Definition and types of reliability
3. Reliability of speeded tests
4. Dependence of reliability on the sample tested
5. Using reliability information

Chapter 4: VALIDITY

1. Validity: Definition and evolving concepts
2. Content-description validation procedures
3. Criterion-prediction procedures
4. Construct-identification procedures
5. Test validity and decision theory

Chapter 5: CORRELATION AND REGRESSION

1. Concept and meaning of correlation
2. Pearson's Product-Moment Correlation
3. Point – Biserial Correlation and Phi-coefficient
4. Bi-serial and tetra choric correlation
5. Partial and Multiple Correlation
6. Simple Linear Regression: Concept and uses

Chapter 6: INFERENTIAL STATISTICS

1. Inferences: Standard error of mean and other statistics
2. Significance of difference for means, variances and correlation coefficients.
3. Assumptions of Analysis of Variance, and One-way ANOVA- Independent, concept of repeated measures
4. Two-way ANOVA - Independent, concept of repeated measures
5. Analysis of Covariance: Concept.

Chapter 7 : TYPES OF MEMORY

1. Sensory memory- Iconic and echoic
2. Short Term Memory
3. Long Term Memory: Types
4. Determinants of memory
5. Applications: Memory improvement techniques

Chapter 8: NEUROLOGICAL BASIS OF LEARNING AND MEMORY

1. Brain areas associated with learning and memory
2. Types of Amnesia- Amnesia after concussion (Anterograde, Retrograde), Korsakoff, Alzheimer's disease
. Studies on role of brain in learning and conditioning
4. Synaptic mechanisms and synaptic plasticity of learning and memory
5. Application: Neuro-linguistic programming.

Chapter 9: EXPERIMENTAL DESIGNS

1. Experimental designs: Definition, principles and functions
2. Between-group designs: Randomised group designs
3. Between-group designs: Block designs- a) two group designs, b) randomized block designs with more than two groups
4. Factorial designs: Simple factorial designs, factorial designs with covariate, randomized block factorial designs
5. Conceptual distinction among between group designs, repeated measures designs, and mixed designs.

Chapter10: QUASI-EXPERIMENTAL DESIGNS AND SCALING

1. Characteristics and types of quasi-experimental designs: Single-group designs, pre test-post test designs
2. Non-equivalent control group designs, discontinuity promotion designs, time series designs, cohort designs
3. Application of quasi-experimental designs in program evaluation research.
4. Scaling: Purpose, psychophysical scaling
5. Scaling: Psychological scaling: Thurstone-type scales (i.e. differential), and Likert-type scale (i.e. summated)

Syllabus for Entrance Test for PhD Programme in Women's Studies

Contact Address: wsc@unipune.ernet.in

The syllabus for the entrance test for a doctoral programme in Women's Studies will consist of four compulsory modules. Candidates may choose any two from the remaining five optional modules

Four Compulsory Modules

1. Feminist Movements and Theory
2. Development: Gender Perspectives
3. Theory of Gender in India
4. Feminist Research Methodology

Five Optional Modules (Select any two)

1. Gendering Social History
2. Culture: Gender Perspectives
3. Theory of Gender in India
4. Gender, Nation and Community
5. Gender and Sexualities: Perspectives and Issues Gender and Dalit Stud

Compulsory Modules

Module 1

Feminist Movements and Theory

Global distribution of power, European modernity and feminist thought in Europe and USA, Latin America, West Asia, South Asia, Africa and Far East ,Feminist Classics in Europe and USA: Reading 'Difference' , Sex and Gender,Feminists Debates in Liberalism and Radical and Dominance Approaches, post structuralism ,Feminist Debates in Marxist and Materialist Feminisms, Feminist Debates on race, class and nation ,Feminist Postcolonial Theory

Module 2

Development: Gender Perspectives

Feminism and Development: Emergence of Women as a Constituency in Development: WID, WAD And GAD, Development and the Indian Nation State: Landmark Policies, Plans, Reports and Commissions, Women's Movements in India: Post- 1975 Campaigns, Issues and Challenges, Gender and Institutions: Labour, Politics, Family and Household, Gender and Institutions: Health and Sexuality, Law, Education

Module 3
Theory of Gender in India

Engendering Disciplines and Theorizing Gender in India, Family, Kinship and Household Debates on Sexuality, Nation and Community, Constitution and Law as Subversive Sites Caste, Class and Community

Module 4
Feminist Research Methodology

Science, Nature and Gender-Feminism and Paradigm Shift, Quantitative and Qualitative Research: An Introduction Feminist Epistemology, Methodology and Method
What is Distinctive about Feminist Method? Feminist Reworking of methods of research, Reflexive Research: Feminist Contributions, Dilemmas and Ethics

Optional Modules (any Two)

Module 1
Gendering Social History

The Significance of History: Why Social History, Different Perspectives, Debates in Feminist Historiography (Feminist Engagements with Left/ Non-Brahmin/ Subaltern/ Post Colonial), Rewriting Histories: Feminist Interrogations, Recasting of Women in Modern Social Institutions in India, Doing Social History: From Gender and Caste Perspective

Module 2
Culture: Gender Perspectives
Gender and Culture: Basic Concepts, Approaches to the Study of Culture
Feminist Renderings of Representation, Ideology, Hegemony, Folk- Popular- Public Culture, Studying Cultural Practices: A Gender, Caste And Class, untangling Contemporary Cases/ Issues: Shah Bano and Roop Kanwar Cases, Practices of Anti- Mandal Protests, Controversies Against Beauty Contests/ Dress Code, 'Fire' Controversy

Module 3
Gender, Nation and Community
Colonialism, Nationalism, and the Woman Question-The debates around anti-colonial and nationalist movements, ideas, and theories, Gender, Nation and State- The influence of state and religious communities on the construction of gendered identities.
Gender a lens to interpret the actions of the state, Sexual and gendered imageries in religious and ethnic communities.

Module 4
Gender and Sexualities: Perspectives and Issues
Theoretical Perspectives: Liberationist, Identity Politics, Difference, Social Constructionism, Queer Theory- Focus on Post- 1970s Developments,Sexualities, Modernity and History, State, Market and Sexualities: Engaging with Issues of Violence and Desire, Debating Sexual Citizenship, Sexualization of Work,Sexualities, Movements and Rights: Debating Sex – Work, Same Sex Love and Friendships, AIDS Discrimination.

Module 5
Gender and Dalit Studies

Emergence of Dalit Studies and Relationship to Gender Studies in India,Nation, Caste and Gender: Reviewing Classics on Woman's Question and Caste Question in Colonial India ,Caste, Class and Community (Debates on Violence of Brahmanical Patriarchy, Caste and Marxism, Caste and Hindutva, Conversion, Caste and Woman's Question**)**,Caste, Gender and Democracy in India

The Pattern of the Question paper:

Compulsory Modules:

Questions on these four modules in Section I will test the applicants knowledge of basic concepts, methodology, theory in India and across different regions.

Section I (20 marks)

The questions will be Objective type questions

(Answer briefly/explain) – Any four from seven questions of five marks each

Section II (40 Marks)

Essay Type questions – Any two from five of 20 marks each

Optional Modules:

Section III (40 Marks)

Two Essay type questions on any two themes: Any two questions from Five each on one optional module of 20 marks each

Sample Paper

SAMPLE QUESTION PAPER (3 Hours)

Note

1. **Students must attempt all sections**
2. **Section I carries 20 Marks**
3. **Section II and III carry 40 Marks Each**

Section 1

Answer any Five of the following concepts briefly. Every Question carries equal marks: (Total 20 Marks)

a. **Postcolonial Feminism**
b. **Concept of Difference**
c. **Sex and Gender**
d. **WID/WAD/GAD**
e. **Intersectionality of Gender, Caste and Class**
f. **Feminist epistemology**
g. **Patriarchy**

Section II

Answer on any two of the following five questions. Every Question carries equal marks: (Total 40 Marks)

a. **Outline the major debates in Marxist and Materialist feminisms.**
b. **Trace the development of women as a constituency in Development.**
c. **Elucidate the problems for doing a theory of gender in India.**
d. **Is the Feminist Method distinctive? Support your answer with an illustration.**
e. **Why are constitution and law considered as subversive sites for feminist politics?**

Section III

Answer on any two of the following five questions. Every Question carries equal marks: (Total 40 Marks)

a. **Outline the major debates in feminist historiography.**
b. **Drawing upon any major controversy in the cultural sphere in contemporary India explain why culture is a gendered concept.**
c. **Write an essay mapping the relation between colonialism, nationalism and the woman question in India.**
d. **Map the different theoretical persectives in feminist studies on sexuality/ies.**
e. **Write an essay on the concept of Brahmanical patriarchy highlighting the structural violence that links caste and gender in India.**

Entrance Test for Ph.D.

Physical Education

University of Pune

Syllabus and Structure for Paper – II

The total marks for Paper – II is 100 and time allotted is 2 hours. The paper consists of two parts A & B.

Part A consists of 20 objective type questions (multiple choice, matching type, true / false, assertion – reasoning type, etc.) each question will carry one mark (total marks 20) All questions will be compulsory.

Part B will consist of 8 questions arranged in 3 sections.

Section I :

Candidates have to write a critique of a given para or stanza from a known thinker / writer. Three carefully considered specific questions will be asked on the given para, requiring an answer in upto 30 words each. This section shall carry 3 × 5 = 15 marks.

Section II :

Four extended answers based on analytical / evaluative questions will be set across the syllabus. There will be internal choice. (4 out of 8 questions) Each question will be answered in upto 200 words and shall carry 10 marks (4 × 10 = 40 marks).

Section III :

Essay writing – One question with internal choice on general themes and contemporary, theoretical or of disciplinary relevance will be given. (1 out of 4 questions) The candidate would answer it in up to 600 words. (25 marks)

Ph.D. Entrance – Paper - II

PHYSICAL EDUCATION

SYLLABUS

Unit—I :

Introduction to and definition, aims and objectives of Physical Education and other terms-health education and recreation.

Philosophical basis of Physical Education.

Biological basis of physical activity-benefits of exercise, growth and exercise, exercise and well-being, sex and age characteristics of adolescent. Body types.

Psychological basis of physical Education-Play and Play theories. General principles of growth and development, Principles of motor-skill acquisition, transfer of training effects.

Sociological basis of physical Education-socialization process, social nature of men and physical activity, sports as cultural heritage of mankind, customs, traditions and sport, competition and cooperation.

Olympic Movement-and its impact.

Physical Education in India.

Unit—II :

Physiology of muscular activity, Neurotransmission and Movement mechanism

Physiology of respiration

Physiology of blood circulation.

Factors influencing performance in sports.

Bioenergetics and recovery process.

Athletic injuries-their management and rehabilitation.

Therapeutic modalities and exercise

Ergogenic aids and doping.

Posture – Postural Deformities

Unit—III :

Joints and their movements-planes and axes.

Kinetics, Kinematics-linear and angular, levers.

Laws of motion, principles of equilibrium, force, spin and elasticity.

Muscular analysis of Motor movement.

Mechanical analysis of various sports activities.

Mechanical analysis of fundamental movements- running, jumping, throwing, pulling and pushing

Unit—IV :

Learning process - theories and laws of learning.

Motivation, theories and dynamics of motivation in sports,

Psychological factors affecting sports performance-viz., stress, anxiety, tension and aggression.

Personality, its dimensions, theories, personality and performance.

Individual differences and their impact on skill learning and performance.

Group dynamics, team cohesion and leadership in sports.

Sociometrics, economics and politics in sports.

Unit—V :

Development of teacher education in Physical Education.

Professional courses in Sports and Physical Education in India

Professional Ethics.

Qualities and Qualifications of Physical Educational Personnel

Principles of curriculum planning.

Course content for academic and professional courses.

Age characteristics of pupils and selection of activities.

Construction of class and school physical Education time table.

Unit—VI :

Health-Guiding principles of health and health education.

Nutrition and dietary manipulations.

Health-related fitness, obesity and its management.

Environmental and occupational hazards and first aid.

Communicable diseases-their preventive and therapeutic aspects.

School health program and personal hygiene.

Theories and principles of recreation.

Recreation program for various categories of people.

Unit—VII :

Characteristics and principles of sports training

Training load and periodization – short term & long term plan

Training methods and specific training program for development of various motor qualities.

Technical and Tactical preparation for sports.

Sports talent identification process and procedures.

Preparing for competition-build up competitions, main competition, competition frequency, Psychological preparation.

Unit—VIII :

Nature, scope and type of research

Formulation and selection of research problem.

Sampling-process and techniques.

Methods of research.

Data collection-tools and techniques.

Statistical techniques of data analysis-measures of central tendency and variability correlation, normal probability curve, t-test and chi-square, ANOVA

Hypothesis-formulation, types and testing.

Unit—IX :

Concept of test, measurement and evaluation.

Principles of measurement and evaluation

Construction and classification of tests.

Criteria of test evaluation.

Concepts and assessment of physical fitness, motor fitness, motor ability and motor educability and skill tests.

Testing psychological variables-competitive anxiety, aggression, team cohesion motivation, self-concept.

Anthropometric measurements and body composition.

Unit—X :

Concept and principles of management

Management of infrastructure, equipments, finance and personnel.

Media & Sports

Instructional Process in Physical Education – essential elements, optimizing learning, effectiveness, class management, methods & techniques of teaching.

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Ph.D. Entrance – Paper - II

Ayurved

SYLLABUS

F) Rogvidnyan vikruti Vidnyan

1) Dosha Dooshyadi Vigyanam
2) Vyadhi Vigyanam
3) Basic Pathology.
4) Nidana Panchaka Vigyanam
5) Pareeksha Vigyanam

1) Diseases of Rasavaha Srotas.
2) Diseases of Raktavahasrotas.
3) Diseases of Mamsavaha srotas.
4) Diseases of Medovaha sortas.
5) Diseases of Asthi – Majjavaha srotas.
6) Diseases of Sukravaha srotas.
7) Diseases of Pranavaha srotas.
8) Diseases of Annavaha – Pureeshavaha srotas.
9) Diseases of Udakavaha srotas.
10) Diseases of Mutravaha srotas.
11) Diseases of Swedavaha srotas.
12) Diseases of Manovaha srotas/Sanjnavaha srotas.
13) Upasargajanya Vyadhis (Communicable diseases)
14) Krimi Vigyanam,

Agadtantra.

1) Derivation.
2) Origin and classification of Visha.
3) Tests for detection of Visha, Visha Data Lakshana,
4) Contamination of air, water, soil etc.
5) Signs and Symptoms of poisons of plant kingdom and their management
6) Gara visha, Dooshi visha and, Viruddhahara
7) Study of chaturvimshatyupakrama of Caraka.
8) Jangama Visha
9) Acids and Alkalis.
10) Asphyxiants
    Stimulants
    Hallucinogens
    Sedatives and Hypnotics
    Petroleum
    Organo phosphorus compounds.

11) Definition of Toxicology, classification of poisons, their actions and routes
12) Metallic and non metallic poisoning.
13) Madya Visha and Madatyaya; Alcohol poisoning (Ethanol and Methanol)
14) Laws related to poisons.

1) Introduction, Definition
2) Personal identity and its medico
3) Death and its Medico Legal Aspects.
4) Medico legal autopsy and exhumation.
5) Injuries and wounds and its medico legal aspects.
6) Dowry deaths, their medico
7) Asphyxial deaths and its Medico
8) Death due to heat, cold and starvation.
9) Virginity, Pregnancy, Delivery.
10) Sexual offences
11) Forensic psychiatry.
12) Ethics as in classics.
13) Laws in relation to medical practitioners.

Kayachikitsa.

1) Derivation of the terms "Kaya; "Chikitsa.
2) Importance of Kriyakala
3) Chikitsa sutra and Management of vriddhi
4) Detailed description of Dvividhopakrama
5) Detailed description of chikitsa sutra and Management of jwara and its types.
6) Relevant Ayurvedic management
7) Knowledge of National Health programmes
8) Introduction of general principles of maintainance of health.

1) Chikitsa sutra and Management of the diseases of Pranavaha srotas
2)Chikitsa sutra and management of the diseases of Udaka vaha srotas.
3)Chikitsa sutra and Management of the diseases of Annavaha Srotas.
4)Chikitsa sutra and Management of the diseases of Rasavaha srotas
5)Chikitsa sutra and Management of the diseases of Raktavaha srotas
6)Chikitsa sutra nd Management of Mamsavaha Srotas
7)Chikitsa sutra and Management of 'Ashti and Majjavaha srotas
8)Chikitsa sutra and Management of diseases of Mutravaha srotas
9)Chikitsa sutra and Management of diseases of Purishavaha srotas.
10)Chikitsa sutra and Management of sexually transmited diseases.

1)Principles of treatment and management of Vata Vyadhis
2)Nidana and Chikitsa of Urusthambha,
3)Diseases of different Endocrine Glands.
4)General introduction and Principles of management
5)Treatment of Motion sickness.
6)Derivation of the term 'Manas; its stan
7)Nidana and Chikitsa of the following disorders

8)Management of Vardhakyajanita vikaras
9)Etiopathogenisis and modern management
10)Nutritional deficiency disorders
11)Decription and management of following Emergency conditions.
12)Derivation, definition and synonyms of Rasayana,
13)Vajikarana
14)Properties, doses, methods of administration, ingredients and methods of formation of Rasayana & Vajikarana formulation.
15)Classification and importance of Vajikarana Dravyas.

1)Shiro roga
2)Karna roga
3)Nasa roga
4)Mukha roga (Diseases of oral cavity)
5)Oshtha roga (Diseases of Lips 0
6)Danta roga (Dental Diseases)
7)Danta mula gata roga (Diseases of Periodontia)
8)Jihwa gata roga (Diseases of Tongue)
9) Talu roga (Diseases of Palate)
10) Kantha and gala gata roga (Diseases of Pharynx & larynx)

Shalyatantra.

1) Introduction to Shalyatantra.
2) Definition of Shalya, Shalya tantra.
3) Description of Yantras, Shastras, Anushashtras
4) Nirjantukarana
5) Sangyaharana
6) Trividha Karma
7) Ashtavidha Shastra Karma
8) Yogya vidhi
9) Marma – Nirukti.
10) Kshara and Kshara Karma
11) Kshara sutra
12) Agnikarma
13) Raktamokshana
14) Bandha vidhi
15) Sandhana Karma
16) Pranasta shalya and Nirharana Upayas
17) Fluid, electrolyte and Acid Base Balance,

1) Manya Vikara
2) Sira Vikara
3) Dhamani Vikara
4) Snayu vikara.

1) Asthi Bhagna
2) Sandimoksha
3) Disease of bone

4) Cranio-cerebral injuries
5) Diseases of breast
6) Diseases of chest.
7) Diseases of esophagus
8) Gulma Roga
9) Diseases of stomach and duodenum
10) Diseases of small intestine
11) Diseases of large intestine.
12) Udara rogas
13) Diseases of rectum and anal canal.
14) Diseases of liver
15) Diseases of gall bladder
16) Diseases of pancreas
17) Diseases of spleen.
18) Diseases of Kidney.
19) Diseases of Ureter.
20) Diseases of Urinary bladder
21) Mutragata & Mutrakrichra
22) Diseases of prostate.
23) Diseases of Urethra
24) Diseases of Penis
25) Diseases of Scrotum and Testis.
26) Vriddhi Roga
27) Antravriddhi

Stree-rog Prasutitantra.

Introduction and scope of Prasutitantra
Stri sharer vigyana
Rajo vidgyana
Garbha vigyana
Garbinivigyan
Garbhini vyapad/Garha vyapad
Prasava vigyana (Parturition)
Prasava vyapad (Disorders of Labour)
Sutika Vigyana
Sutika Roga
Stanya vigyana
Atyayika chikitsa in prasuti

Artava vyapad
Yoni vyapadani
Shukra vigyana
Vandhyatva
Stanaroga
Sthanik chikitsa
Shastra Karma

Kaumarbhritya

1) General Introductionof Kaumarbhritya
2) Vayobheda
3) Importance of Kashyapa Samhita in kaumarbhritya.
4) Navajata Shishu
5) Purvajata
6) Paschatajata
7) Prana
8) Navajata
9) Kumaragara
10) Navajat Shishu Poshana
11) Stanyadosha
12) Dhatri
13) Garbha Vridhi Vikasa Kram
14) Importance of Kreedabhumi
15) Poshana
16) Sanskaras
17) Dantotpatti
18) Vyadhikshamatva
19) Lehana
20) Knowledge of National Programs.

Samanya chikitsa Siddhanta and Balaroga

1) Balaroga Samanya chikitsa siddhanta
2) Aushadhi Matra Nirdharana
3) Specific therapeutic procedures
4) Prasava kaleena Abhigata
5) Sahajavyadhi
6) Anuvanshika Vyadhi
7) Prasavottara Vyadhi.
8) Dushta Stanyapanajanya Vyadhi
9) Kuposhanajanya Vyadhi
10) Anupasargika Vyadhi.
11) Srotas Vikara.
12) Anya Balavikara
13) Behavioral disorders of children
14) Atyayika Balaroga Prabandhana
15) Bakagraha
16) Various Ayurvedic & Modern Procedures.

Panchakarma

1) Introduction to Panchakarama
2) Relation of Panchakarma
3) Threefold Karma

i) poorva Karma
ii) Pradhana
iii) Pashchat Karma

4) Usefulness of Shodhana
5) General precautions
6) Relevance of Panchakarma in present era.
7) Specifications of Panchakarma theatre and necessary equipments.

II) Snehana

Poorvakarma
Pradhana Karma.
Pashchat Karma
8) Diet and regimens during Snehana
9) Introduction to Bahirparimarjana Chikitsa.
10) Detailed Knowledge about procedure
11) Snehana Kamukata.
12) Digestion and Metabolism of Fat.

III) Swedana

IV) Vamana

Poorva Karma

V) Virechana Karma

VI) Basti.

VII) Nasya

VIII) Rakta Mokshana and Vyayamopachara

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UNIVERSITY OF PUNE
FACULTY OF EDCUATION
SYLLABUS FOR Ph.D. PROGRAMME IN EDCUATION

From 2009

1. Concept of research, Concept of educational research, Research and theory development, Limitations of Scientific inquiry.
2. Need of research in Education, source of research problem, formulating a research problem.
3. Approaches of research:- Fundamental/Basic, Applied, Action, Qualitative and Quantitative
4. Review of related literature, abstracting, References, Bibliography.
5. Research methods :- Historical, Survey, Experimental, Quasi-experimental, Product research, Mixed method, Case study, Single subject study Phenomenological study, Anthropological & Ethnographic Study.
6. Tools and techniques of research:- Data collection tools, Types of data collection Techniques, Selection of appropriate Statistical Method.
7. Analysis of data:- Descriptive data analysis, inferential data analysis, Interpretation of data.
8. Writing a research proposal.
9. Writing a research report:- General rules of report writing, Area, Title, Need and Importance, Significance of the study, Statement of the problem, Objectives, Operational definitions, Review of related literature, Assumptions, Hypothesis, Population and sample, sampling methods, Scope, limitations and delimitations, Control of variables, Internal and external validity, Methods of research, Tools of data collections, Statistical tools, Finding and conclusions, Implications of the study, Suggestions for further research, Bibliography, References, Appendices.
10. Mechanics of writing a research article.
11. Research ethics, intellectual property rights.
12. Research report evaluation
13. Exploring new areas and contemporary issues for Educational Research.
14. Use of advanced technology in various phases of Educational Research, Online references, Use of SPSS.
15. Creation of knowledge –

A. Sources of knowledge

1. Experience
2. Authentication
3. Induction
4. Deduction

B. Generalisation

1. Formulation of Theory
2. Falsification of Theory

17. Discussion of Result

UNIVERSITY OF PUNE
FACULTY OF EDCUATION
PH. D. ENTRANCE EXAMINATION 2009-10
PAPER – II STRUCTURE

Time – 2 hrs.

PART – A: OBJECTIVE (20)

It contains 10 objective type questions having two marks each

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PART – B: DISCRIPTIVE (80)

Q. 1 Answer in 250-400 wards (20)
२५० ते ४०० शब्दात उत्तर लिहा

Q. 2 Answer in 250-400 wards (20)
२५० ते ४०० शब्दात उत्तर लिहा

Q.3 Answer in about 100 wards of each a & b
१०० शब्दा दरम्यान अ व ब ची उत्तरे लिहा

a) (10)

b) (10)

Q.4 Answer any four out of the following (Answer in 30 to 40 wards) (20)
(Any Four) / खालील प्रश्नांची उत्तरे लिहा. (३० ते ४० शब्दात उत्तरे लिहा) (कोणतेही चार)

a)

b)

c)

d)

e)

Faculty of Management

Structure of Paper II – for PhD Entrance Examination

The paper II will of 100 marks divided in three sections.

Section 1: Key concepts of General Management, Managerial Functions perspective: (20 objective type questions, one mark each. Total 20 Marks)

Section 2: Specialisation Subjects. Descriptive type questions consisting of one short note out of three options, 5 marks. Three questions with internal options 15 marks each. (Total 50 marks)

Section 3: Case study based on applications of Research methodologies (30 Marks)

Section number	Subject	Type of Questions	Maximum Marks
1	Key concepts of General Management, Managerial Functions perspective	20 Objective type questions	1*20=20
2	Optional Subjects	1 short note out of 3 Three questions with internal options	1*5=5 3*15=45 Total 50
3		Case Study based on applications of Research methodologies	30
		Total Marks	**100**

Optional Subjects

Serial No	Subject Code	Subject
1	A	Marketing Management
2	B	Financial Management
3	C	Computer Management

4	D	Production Management
5	E	Human Resource Management
6	F	Foreign Trade Management
7	G	Organization Management & Economic Environment
8	H	Hotel Management
9	I	Knowledge Management
10	J	Bio-technology Management

Paper II

This paper will consist of 3 sections:

Section I

Key concepts of General Management, Managerial Functions perspective: **(20 Marks, 20 objective type questions)**

a) Economics: Concepts about National Income, Market Structures, Demand- Supply Analysis, Demographic features, Banking and its Functions
b) Communication: Types of communication, process of Communication, Need for communication, communication Barriers
c) Leadership: Classification – Types of Leadership, Qualities- characteristics of good leader, Identification of Leadership traits.
d) Quantitative Techniques: Graphical- tabular representation of data, Tools for Data processing, Correlation-Regression- association analysis,
e) Managerial Functions: Planning, Organizing, Controlling, Directing
f) Entrepreneurial Functions: Risk, uncertainty bearing innovations strategic functions

Section II

(Descriptive type- 50 marks, short note any one out of three, 5 marks. Three questions internal options 15 marks each)

<u>Marketing (A)</u>

a) Marketing Mix (4 P's of Marketing & 7 P's of Services Marketing)
b) Marketing Myopia---Concept, Nature & Scope
c) Market Segmentation--Targeting & Positioning, Marketing Strategy Formulation.
d) Product Life Cycle, Introduction of New Product into the Market Place.
e) Product/Brand Positioning,
f) Pricing Methods & Pricing Strategies.
g) Marketing Research, Marketing Intelligence, Marketing Decision Support Systems(MDSS)

h) Advertising, Sales Promotion, Personal Selling, Direct Marketing, Publicity. Advertising---Planning, Execution & Evaluation

i) Distribution Channels, Wholesaling & Retailing

j) Current Trends in Marketing (Advertising & Retailing on the Net, CRM, Green Marketing, Turbo Marketing, Holistic Marketing)

Financial Management (B)

a) Nature and scope of Financial Management – Objectives of Financial Management – Relationship with other functional areas of Management

b) Risk and Return – Portfolio Theory – CAPM

c) Analysis and Interpretation of Financial Statements – Ratio Analysis – Funds Flow and Cash Flow Statements – Economic Value Addition

d) Capital Budgeting – Appraisal Techniques – Discounted and Non Discounted Cash Flow Techniques - Appraisal under the conditions of Risk and Uncertainty

e) Working Capital Management – Determinants and Financing of Working Capital – Cash Management – Receivables Management – Inventory Management.

f) Capital Structure Planning – Concept of Cost of Capital – Leverage Analysis

g) Elements of Derivatives

h) Decision making tools and techniques – use of Management Accounting Techniques like Marginal Costing in decision making

Computer Management (C)

a) Algorithms & Programming Concepts: Concepts of well proposed concepts, Definition of Algorithms Recursive & iterative algorithms, Objectives of algorithms. Quality of algorithm, space complexity & time complexity of algorithm Frequency analysis and problem complexity.

b) Programming concepts: Introductions, Programming language syntax, Name, scope binding, Semantic analysis, Data types, Subroutine & control abstraction, Data abstraction & object oriented concepts, Concurrency

c) Programming in C++ / Java/Ruby, dot net technology:

   a. *C++:* Object oriented concepts, Objects & classes, Constructor & destructor, Functions, Inheritance, Operator overloading, Runtime polymorphism, Templates, Exceptional handling

   b. *JAVA:* Objects & classes, Language features, Exception handling, Collection framework multithreading, Abstract window tool kit & applet , streams & file

input output, servlets, JSP(Java server pages), Remote method invocation, Java Networking, Introduction to Java bean, Enterprise Java beans, Struts

d) Data Base Management System: Introduction to database systems, Introduces relational database management systems as a class of software systems. Design theory, query language and performance/tuning issues. relational Algebra, SQL, stored procedures, user-defined functions, cursors, embedded SQL programs, client-server interfaces, entity-relationship diagrams, normalization, B-trees, concurrency, transactions, database security, constraints, object-relational DBMSs, specialized engines such as spatial, text, XML conversion and time series.

e) Implementation of database management systems: Explores the internals of database management systems. Introduction of cursor, triggers, view & stored functions. SQL Query optimization in centralized and parallel systems, use of B-tree indexes for efficiency, nested loop, sort/merge and hash-partition, joins, histograms for estimation, lock and unlock. Introduces recovery, log record structure, log functions, fuzzy check pointing, buffer manager structure, LRU replacement, FIX rule, WAL rule, two-phase commit with presumed abort optimization and replication.

f) Special Topics in Database Management: Object-oriented database systems and distributed data-base systems. Transaction Concepts, Deadlock, detection & recovery, prevention algorithms, serializability, schedules concurrency ,Crash recovery. Recovery concepts, techniques, checkpoint , recovery with concurrent transaction (rollback, commits),catastrophic failure.

g) Client – Server technologies : Client- server information system, client server architecture. database middleware components.

h) SPM : Concepts of software management: software crisis , principles of software engineering , programming in large, Software methodologies/ processes , Software measurement, Object oriented requirement analysis & modelling, Software architecture, Software design, Implementation, Documentation, Project management, Safety & maintenance, Configuration management, PERT & CPM.

i) Software Inspection , Quality Assurance & Testing

Software Review & Inspection process, Software Quality Assurance - Quality plan, Quality metric, V&V , software testing – purpose, levels of testing, test cases, types of testing

j) Emerging Trends in Information Technology

E-banking, e-governance, e-agriculture, Embedded systems, Biometric technologies like fingerprint identification, RFID etc, GIS & GPS

k) Case Studies**:** Online reservation, Shopping cart, Online classified, Online matrimony, Payroll system, Administration system, Inventory system, Examination system

l) Web Application : HTML, Basic principles of web design, e-Commerce, On line Business application, Use of Internet

Production Management (D)

a) Role and Scope of Production management, Evolution into operations management

b) Production planning and control

c) Facilities location & Layout

d) Materials Handling

e) Purchasing, Sourcing

f) Work measurement, Time and Motion studies

g) Statistical Quality Control, Control Charts, Quality Assurance, TQM, ISO

h) Demand forecasting.

Human Resource Management (E)

a) Human Resource Management (HRM)-Significance; Objectives; Functions; A diagnostic model; External and Internal environment; Forces and Influences; Organizing HRM function.

b) Recruitment and Selection-Sources of recruits; Recruiting methods; Selection procedure; Selection tests; Placement and Follow-up.

c) Performance Appraisal System-Importance and Objectives; Techniques of appraisal system; New trends in appraisal system.

d) Development of Personnel-Objectives; Determining Needs; Methods of Training & Development programmes; Evaluation.

e) Career Planning and Development-Concept of career; Career planning and development methods.

f) Compensation and Benefits-Job evaluation techniques; Wage and salary administration; Fringe Benefits; Human resource records and audit.

g) Employee Discipline-importance; causes and forms; Disciplinary action; Domestic enquiry.

h) Grievance Management-Importance; Process and Practices; Employee Welfare and Social Security Measures.

i) Industrial Relations-Importance: Industrial conflicts; Causes; Dispute settlement machinery.

j) Trade Unions-Importance of Unionism; Union leadership; National Trade Union Movement.

k) Collective Bargaining-Concept; Process; Pre-requisites; New trends in collective bargaining.

l) Industrial Democracy and Employee Participation-Need for industrial democracy; Pre-requisites for industrial democracy; Employee. Participation-Objectives; Forms of Employee Participation.

m) Future of Human Resource Management.

Foreign Trade Management (F)

a) India's Foreign Trade and Policy; Export promotion policies; Trade agreements with other countries; Policy and performance of Export zones and Export-oriented units; Export incentives.

b) International marketing logistics; International logistical structures; Export

c) Documentation framework; Organization of shipping services; Chartering practices; Marine cargo insurance.

d) International financial environment; Foreign exchange markets; Determination of exchange rates; Exchange risk measurement; International investment; International capital markets; International Credit Rating Agencies and Implications of their ratings.

e) WTO and Multilateral trade agreements pertaining to trade in goods; trade in services and TRIPS; Multilateral Environmental Agreements (MEAs);

f) International Trade Blocks-NAFTA, ASEAN, SAARC, EU, WTO and Dispute Settlement Mechanism.

g) Technology monitoring; Emerging opportunities for global business.

Organization Management & Economic Environment (G)

a) Management --concept and definition--Process--Theories of decision making--Leadership--Theories Traits.

b) Definition and nature of economics--- Macro and Micro economics-- Concept of managerial economics-- pricing theories--Capital budgeting-- National income concept---Business environment.

c) The concept and significance of OB Org design and culture --values--attitudes---personality---change management-- managing conflicts--orgnisational development.

d) Corporate strategy-- concept-- BCG matrix--SWOT Analysis--Industry analysis---Types of strategies-- Implementing strategies---Balance score card---People side of implementation-- Strategies for managing in Global environment.

e) Entrepreneurship-- concept--trait--contribution to economic development---Govt policy towards small and tiny sector--- Problem of sickness and rehabilitation---Women Entrepreneurs---- importance measures to encourage women entrepreneurs—problems.

f) Social responsibilities of business--- ethical issues--Corporate ocial responsibility and ethics.

Hotel Management (H)

a) Management in Tourism, Economics of Tourism and Hospitality Industry.

b) Management Functions and Behaviour in Tourism Managing Personnel in Tourism.

c) Tourism Planning and Development Tourism Products : Design and Development Tourism Operations, Customer Relationship Management Principles.

d) Practices of Hospitality Management Tourism Destination Management Business Environment and Legislation in Tourism Global Tourism Resource Management.

Knowledge Management (I)

a) Knowledge and Knowledge Management: Definitions sources of Knowledge management.

b) Knowledge creation**:** Human aspects of Knowledge creations**.**

c) Need for Knowledge Management**:** Knowledge Management today knowledge acquisition tools Data, information, knowledge, wisdom.

d) Categorisation of knowledge Management: conflicts of the knowledge management process Knowledge Management approaches.

e) Various models of Knowledge Management**:** Knowledge Management infrastructure design and issues.

f) Basic Components of Knowledge Management Systems.

g) Knowledge Communities and need for Knowledge Communities.

h) Architectures for Knowledge Management System**:** knowledge Assets-Role of Taxonomy in Knowledge Management.

i) Corporate Intranet: Knowledge Ecologies,- Knowledge Management careers.

j) Knowledge originations and their need-future of Knowledge Management.

Biotechnology (J)

a) Basics of Biotechnology and Bioinformatics: Nucleic Acids and Protein Structure Functions Recombinant DNA technology.

b) Basic Immunology and Hybridoma technology Animal Cell Culture, Basic techniques and applications.

c) Plant tissue culture, floriculture and Herbal medicine.

d) Biotechnology applications in environment protection, biofuel Bioinformatics, databank, data analysis, Sequence comparison, accessing databank Protein Structure databank and application Genomics, Proteomics, Pharmacogenomics, Chemo-informatics.

e) Advances in BT: Stem Cell Research, Tissue Engineering, New Drug Design and Development, Combinatorial Chemistry, DNA Chip Technology, Antibody Engineering Transgenic Plants, Transgenic Animals, Third Generation Vaccines.

f) Dynamics of the Life Science Industry: Global trends in BT, pharma and related industries Challenges in the international market.

Section III

Case study based on applications of Research methodologies in the respective optional subjects.

UNIVERSITY OF PUNE
UNDER FACULTY OF PHARMACEUTICAL SCIENCES
SYLLABI, MODEL QUESTION PAPER

1. PHARMACEUTICS
2. PHARMACEUTICAL CHEMISTRY
3. PHARMACOLOGY
4. PHARMACOGNOSY

ANNEXURE-II

Syllabus for Ph. D Admission Entrance Test (Paper-II) in Pharmaceutical Sciences

1. Pharmaceutics (PY-01):

Development, manufacturing standards, Q.C. limits of Pharmaceutical products and medical devices, labeling of Pharmaceutical products, and the storage as per the pharmacopoeial and other regulatory requirements. Storage of different dosage forms and new drug delivery systems. Biopharmaceutics and Pharmacokinetics and their importance in formulation. Formulation and preparation of cosmetics – lipstick, shampoo, creams, nail preparations and dentifrices, Pharmaceutical calculations.

2. Pharmaceutical & Medicinal Chemistry(PY-02):

Structure, nomenclature, classification, synthesis, SAR and metabolism of the following category of drugs, which are official in Indian Pharmacopoeia and British Pharmacopoeia. Introduction to drug design. Brief introduction to QSAR, Stereochemistry of drug molecules. Hypnotics & Sedatives, Analgesics, NSAIDS. Neuroleptics, Antidepressants, Anxiolytics, Anticonvulsants, Antihistaminics, Local Anaesthetics, Cardiovascular drugs – Antianginal agents, Vasodilator, Adrenergic and Cholinergic drugs, Cardiotonic agents, Diuretics, Antihypertensive drugs, antihyperglycemic agents, Antilipidemic agents, Coagulants, Anticoagulants, Antiplatelet aggregating agents. Chemotherapeutic agents – Antibiotics, Antibacterials, Sulphadrugs. Antiprotozoal drugs, Antiviral, Antitubercular, Antimalarial, Anticancer, Antiamoebic drugs. Diagnostic agents. Preparation, storage and uses of official Radiopharmaceuticals, Vitamins and Hormones. Eicosanoids and their applications.

3. Pharmacology (PY-03):

General pharmacology, Pharmacokinetics, Pharmacodynamics and Toxicology. OECD guidelines, Drug interaction. Pharmacology of drugs acting on central nervous system, Cardiovascular system, Autonomic nervous system, Gastrointestinal system and Respiratory system. Pharmacology of Autocoids, Hormones, Hormone antagonists, chemotherapeutic agents including anticancer drugs. Bioassays, Immuno-pharmacology. Drugs acting on the blood and blood forming organs. Drugs acting on the renal system. Pre-Clinical and Clinical testing of drugs.

4. Pharmacognosy (PY-04):

Pharmacognosy and Phytochemistry, Chemistry, tests, isolation, characterization and estimation of phytopharmaceuticals belonging to the group of Alkaloids, Glycosides, Terpenoids, Steroids, Bioflavanoids, Purines, Guggul lipids. Pharmacognosy of crude drugs that contain the above constituents. Standardization of raw materials and herbal products. WHO guidelines for Standardisation. Quantitative microscopy including modern techniques used for evaluation. Biotechnological principles and techniques for plant development, Tissue culture.

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Common syllabus for all four branches of Pharmaceutical Sciences

1. Drug Regulatory Affairs: Drugs and Cosmetics Act and rules with respect to manufacture

sales and storage. Pharmacy Act, Pharmaceutical ethics, Indian Patent Act 1970,its amendments, concepts of IPR, criteria for granting patents and filing a Indian patent, PCT, Patent infringement. INDA/NDA/ANDA filing. Para-I, II, III, IV filing Hatch-Waxman amendments. Introduction to Patent Search.

2. Pharmaceutical Analysis: Principles, instrumentation and applications of the following: Absorption spectroscopy (UV, visible and IR), Fluorimetry, Flame Emission, Atomic Emission, Electro analytical Techniques. Pharmacopoeial assays. Principles of NMR, ESR, Mass spectroscopy, X-ray diffraction analysis and different chromatographic methods, Thermal Techniques.

3. Pharmaceutical Biochemistry & Microbiology: Biochemical role of hormones, Vitamins, Enzymes, Nucleic acids, Bioenergetics, General principles of immunology. Metabolism of carbohydrates, lipids, proteins, Methods to determine, kidney & liver function, Lipid tests and Immunological Assays. Principles and methods of Pharmacopoeial microbiological assays. Methods of preparation of official sera and vaccines. Serological and diagnostics tests. Applications of microorganisms in Bio-conversions and in Pharmaceutical industry.

4. Clinical Pharmacy: Therapeutic Drug Monitoring, (Dosage regimen in Pregnancy and Lactation, Pediatrics and Geriatrics). Renal and Hepatic Impairment. Drug-Drug interactions and Drug-Food interactions, Adverse Drug reactions. Medication History, Interview and Patient counseling.

Statistical Analysis: Design of Experiments, Optimization techniques, Correlation of data, Parametric and nonparametric tests, Statistical interpretations, Hypothesis testing, Level of significance.

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ANNEXURE-III

Model Question Paper for Ph. D Admission Entrance Test (Paper-II) in Pharmaceutical Sciences

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University of Pune *Paper code*

Faculty: Pharmaceutical Sciences **Subject & Subject code**: Pharmaceutics (PY01)
Date: Time: (Max. time for section-I:30 min.)

SECTION-I

Q. 1.0: Solve all following sub-questions (One mark each) 20 marks

1.1. Molarity of simple syrup USP is
A) 5.8 B) 8.5 C) 4.7 D) 85

1.2. Complete mixing of magnesium stearate with tablet granules will
A) Decrease the crushing strength of tablets B) Increase tablet hardness
C) Increase tablet dissolution D) Increase tablet disintegration

1.3. Rate of elimination of drug from body is, if follows zero order kinetics, then it
A) is constant B) Depends on plasma concentration
C) Depends on type of metabolic pathway D) None of the above

1.4. 2, 2’ , 2”, 2”’ - {[4, 8 dipiperidino (5, 4 -D) pyrimidino - 2, 6 - diyl}dinitrilo} tetraethanol is
A) Disopyramide B) Dipyridamole C) Dicyclomine D) Disulfiram

1.5. The parent nucleus present in the structure aconitine is
A) Benzazulene B) Imidazole C) Indole D) Piperidine

11

1.6. The malonic ester synthesis of barbital yields which of the following main form?
A) α-form B) β-form C) γ-form D) δ-form

1.7. Following receptors are membrane proteins, except
a) Receptors for fast neurotransmitters coupled directly to an ion channel

b) Receptors for many hormones and slow transmitters, coupled to effectors System
c) Receptors for insulin and various growth factors, which are directly linked to Tyrosine kinase.
d) Receptors for steroid hormone
1.8. Opoid receptors act via
a) Opening of potassium channels
b) Inhibition of calcium channels
c) Both (a) and (b)
d) Opening of sodium channels
1.9. $_1$- receptors are coupled with_____ G protein.
a) Gs b) Gi
c) Gq d) Go
1.10. The apparatus recommended in BP for the hydrodistillation of volatile oil is known as _____
A) Soxhlet apparatus B) Clavengers apparatus
C) Supercritical fluid extractor D) Enfleurage
1.11. The amount of volatile oil in volatile oil containing plant is determined by using
A) Soxhlet apparatus B) Karl-Fischer apparatus
C) Clevenger apparatus D) Wildman trap flask
1.12. The chemicals which are coloured red when diluted tincture of alkane stains the cell walls are
A) Peptidoglycan, mucilage B) Cutin, suberin
C) Lignin, protein D) Starch, calcium oxalate
1.13. The C=O (aldehydic) bond shows characteristic stretching band at about
A) 1730 - 1700 cm-1 B) 2830 - 2695 cm-1
C) 1060 - 1275 cm-1 D) 1000 - 1200 cm-1
12
1.14. A Ramachandran plot shows _____
(A) The amino acid residues that have the greatest degrees of rotational freedom.
(B) The sterically allowed rotational angles between the side chain groups in a peptide and the peptide backbone.
(C) The sterically limited rotational angles (domains) where phi and psi are allowed in the protein backbone.
(D) The angles that are allowed about the bonds connecting the amide nitrogen in a peptide bond.
1.15. The neurotransmitter derived from tryptophan is
a. GABA b. Epinephrine c. Serotonin d. nor-epinephrine
1.16. Sterilization indicator used for ethylene oxide sterilization is
A) Bacillus osteoarthropathies B) Bacillus pumilus
C) Bacillus subtilis var. niger D) Pseudomonas dimunata
1.17. If a drug is not labeled in a prescribed manner, it is deemed to be ……..
A) Spurious B) Adulterated C) Substandard D) Misbranded
1.18. The patient suffering from complex partial seizures was treated for six months with carbamazepine, but recently, has been experiencing breakthrough seizures on a more frequent basis. You are considering adding a second drug to this patient' s anti-seizure regimen. Which one of the following is least likely to have a pharmacokinetic interaction with carbamazepine
A) Topiramate B) Tiagabine C) Levetiracetam D) Lamotrigine
1.19. The chi-square distribution always has …….
A) Positive values B) Negative values
C) Positive and Negative Values D) None of the above
1.20. The paired T- test is used to compare …….
A) Median B) Standard deviation C) Mean D) None of the above

13

SECTION-II

Q. No 2. Solve all following sub-questions (One mark each; max limit: 2 lines) 15 marks

2.1. What is exact storage condition for ‘cold’ and ‘cool’ storage as per IP?
2.2. What is Young’ s formula for calculation of paediatric dosage?
2.3. Draw schematic presentation of two compartment open model.
2.4. Enlist evaluation parameters of solution dosage forms?
2.5. Give the working principle of nebulisers?
2.6. What is the most suitable method of sterilization of dismantled glass syringes?
2.7. Iodobenzene mass spectrum doesn’ t contain isotopic mass peak, true or false?
2.8. What are orphan drugs?
2.9. Why can’ t RNA adopt both A & B conformation like DNA?
2.10. What is R/W coefficient and its significance?
2.11. Enlist two each CFCs and non-CFCs propellants used in aerosols.
2.12. What is the difference between nebulizer & orally inhaled aerosol?
2.13. What is FFS technique? Give two examples.
2.14. Name the test which distinguishes the Type-I from Type-II glass as per IP and why?
2.15. What are super disintegrants ? Give two examples.

Q. No 3. Solve all following sub-questions (Two marks each; max limit: 3 lines) 30 marks

3.1. Draw a table showing IP limits for weight variation test for tablets.
3.2. What are Spans and Tweens chemically and what type of emulsions do they form?
3.3. State the volume in ml for following sizes of hard gelatin capsules?
a. 0 b. 00 c. 000 d. 1
3.4. Enlist various film formers and plasticizers used in nail lacquers?
14
3.5. Explain Stoke’ s Law of sedimentation with respect to creaming of an emulsion?
3.6. What are various approaches for colon targeted drug deliveries?
3.7. Explain the term chemical shift in NMR.
3.8. Give principle of ELISA test.
3.9. Deficiency of which enzyme leads to a genetic disorder called alkaptonuria?
3.10. What are three minimum conditions needs to be satisfied for an invention to be Patentable?
3.11. What is a significance of *in vivo - in vitro* correlation?
3.12. What are lakes chemically? What are their advantages over water soluble FDC pigments?
3.13. What is emulgel? Give one formula.
3.14. Give basic formula for calculation of maintenance dose in oral Sustained Release Dosage Forms (SRDFs)
3.15. Give one formula for self microemulsifying drug delivery system

Q. No 4. Solve any five of the following sub-questions (3 marks each; max limit: 7 lines) 15 marks

4.1. State the Raoult’ s law and explain the terms in it?
4.2. Give Griffin’ s HLB scale with corresponding uses of the surfactants?
4.3. Draw a well labeled ‘Typical Plasma Drug Concentration-Time Profile Diagram’ of orally administered formulation.
4.4. Give any one formula with use of each ingredient representing non flocculated suspension.
4.5. Explain the isotonicity calculation for parenteral formula as per Sod. Chloride equivalent method
4.6. Draw scheme for new drug discovery & development process.
4.7. Give the scheme monoclonal antibody production?

Q. No 5. Solve any four of the following sub-questions (5 marks each; max. limit: 15 lines) 20 marks

5.1. State various methods for enhancement of bioavailability of orally administered drugs?

15

5.2. Explain in brief accelerated stability study protocol involving Arrhenius theory?

5.3. Explain in brief with one example 3^2 factorial design for optimization?

5.4. The drug candidate is suffering severe first pass effect and degrading in acidic pH, suiggest drug delivery system for this drug and justify

5.5. Enumerate and explain in brief NDDS approaches for ophthalmic purpose.

5.6. Suggest & justify drug delivery system for a drug acting locally in stomach and having short half life.

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ANNEXURE-III

Model Question Paper for Ph. D Admission Entrance Test (Paper-II) in Pharmaceutical Sciences

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University of Pune *Paper code*

Faculty: Pharmaceutical Sciences **Subject & Subject code**: Pharmaceutical & Medicinal Chemistry (PY02)

Date: Time: (Max. time for section-I: 30 min.)

Instructions to the Candidates

a. All questions are compulsory

b. Answer book of section-I shall be collected at end of 30 minutes from the beginning of the examination.

c. Draw figures, sketches and diagrams where ever necessary.

d. Limit of lines for answers doesn' t apply when figures, tables and schematic diagrams are drawn as a part of answer.

SECTION-I

Q. 1.0: Solve all following sub-questions (One mark each) 20 marks

1.1. Molarity of simple syrup USP is

A) 5.8 B) 8.5 C) 4.7 D) 85

1.2. Complete mixing of magnesium stearate with tablet granules will

A) Decrease the crushing strength of tablets B) Increase tablet hardness

C) Increase tablet dissolution D) Increase tablet disintegration

1.3. Rate of elimination of drug from body is, if follows zero order kinetics, then it

A) is constant B) Depends on plasma concentration

C) Depends on type of metabolic pathway D) None of the above

1.4. 2, 2' , 2" , 2" ' - {[4, 8 dipiperidino (5, 4 -D) pyrimidino - 2, 6 - diyl}dinitrilo} tetraethanol is

A) Disopyramide B) Dipyridamole C) Dicyclomine D) Disulfiram

1.5. The parent nucleus present in the structure aconitine is

A) Benzazulene B) Imidazole C) Indole D) Piperidine

17

1.6. The malonic ester synthesis of barbital yields which of the following main form?

A) α-form B) β-form C) γ-form D) δ-form

1.7. Following receptors are membrane proteins, except

a) Receptors for fast neurotransmitters coupled directly to an ion channel

b) Receptors for many hormones and slow transmitters, coupled to effectors System

c) Receptors for insulin and various growth factors, which are directly linked to Tyrosine kinase.
d) Receptors for steroid hormone
1.8. Opoid receptors act via
a) Opening of potassium channels
b) Inhibition of calcium channels
c) Both (a) and (b)
d) Opening of sodium channels
1.9. $_1$- receptors are coupled with_____ G protein.
a) Gs b) Gi
c) Gq d) Go
1.10. The apparatus recommended in BP for the hydrodistillation of volatile oil is known as _____
A) Soxhlet apparatus B) Clavengers apparatus
C) Supercritical fluid extractor D) Enfleurage
1.11. The amount of volatile oil in volatile oil containing plant is determined by using
A) Soxhlet apparatus B) Karl-Fischer apparatus
C) Clevenger apparatus D) Wildman trap flask
1.12. The chemicals which are coloured red when diluted tincture of alkane stains the cell walls are
A) Peptidoglycan, mucilage B) Cutin, suberin
C) Lignin, protein D) Starch, calcium oxalate
1.13. The C=O (aldehydic) bond shows characteristic stretching band at about
A) 1730 - 1700 cm-1 B) 2830 - 2695 cm-1
C) 1060 - 1275 cm-1 D) 1000 - 1200 cm-1
18
1.14. A Ramachandran plot shows _____
(A) The amino acid residues that have the greatest degrees of rotational freedom.
(B) The sterically allowed rotational angles between the side chain groups in a peptide and the peptide backbone.
(C) The sterically limited rotational angles (domains) where phi and psi are allowed in the protein backbone.
(D) The angles that are allowed about the bonds connecting the amide nitrogen in a peptide bond.
1.16. The neurotransmitter derived from tryptophan is
a. GABA b. Epinephrine c. Serotonin d. nor-epinephrine
1.16. Sterilization indicator used for ethylene oxide sterilization is
A) Bacillus osteoarthropathies B) Bacillus pumilus
C) Bacillus subtilis var. niger D) Pseudomonas dimunata
1.17. If a drug is not labeled in a prescribed manner, it is deemed to be … … ..
A) Spurious B) Adulterated C) Substandard D) Misbranded
1.18. The patient suffering from complex partial seizures was treated for six months with carbamazepine, but recently, has been experiencing breakthrough seizures on a more frequent basis. You are considering adding a second drug to this patient' s anti-seizure regimen. Which one of the following is least likely to have a pharmacokinetic interaction with carbamazepine
A) Topiramate B) Tiagabine C) Levetiracetam D) Lamotrigine
1.19. The chi-square distribution always has … … .
A) Positive values B) Negative values
C) Positive and Negative Values D) None of the above
1.20. The paired T- test is used to compare … … .
A) Median B) Standard deviation C) Mean D) None of the above
19

SECTION-II

Q. No 2. Solve all following sub-questions (One mark each; max limit: 2 lines) 15 marks

2.1. Write chemical name for Benzyl Penicillin (Penicillin G) as per IUPAC nomenclature.
2.2. Give a structural formula of a diuretic, which contains a pyrazine ring?
2.3. Name the specific type of antagonism for the combination of Dimercaprol and mercury.
2.4. Name the liver metabolism products of isoniazide.
2.5. Acyclovir is converted to its triphosphate metabolite by which enzyme?
2.6. Name any antimony compound used as anthelmintics.
2.7. How many NMR signals are possible for following compound?
2.8. What is Reads formula?
2.9. Name the microorganism used in the microbiological assay of Rifampicin IP
2.10. Why pioglitazone is not preferred over sitagliptin in the treatment of type II diabetic patient who is diagnosed with heart failure?
2.11. Absence of which structural feature makes enalapril to prefer over captopril? Why?
2.12. Explain why HMG CoA reductase (Statins) inhibitors are taken at bedtime?
2.13. Calculate the pH of 10^{-8} molar HCL solution
2.14. Enumerate metabolic pathways of lidocaine.
2.15. Explain why acidic drugs are better absorbed from stomach?

Q. No 3. Solve all following sub-questions (Two marks each; max limit: 3 lines) 30 marks

3.1. Draw the four stereo isomers of ephedrine.
3.2. Write the structure of active metabolite of testosterone.
3.3. Outline the synthesis of isoniazid
3.4. Enlist any two long- and fast-acting insulin analogues.
H_3C
Br
COOH
20
3.5. One of the isomers of ibuprofen is biologically active whereas other possesses very very low activity. It is quite possible to manufacture and market only active isomer. In spite of this fact, explain why ibuprofen is marketed as racemic mixture?
3.6. Enlist minimum four diseases or ailments from Schedule J for which no drug can claim to prevent or cure.
3.7. Explain the term chemical shift in NMR.
3.8. Write the significance of *chi*-square test,.
3.9. What is cheese reaction?
3.10. What are intellectual property rights (IPR)?
3.11. What is Biuret test? Which types of compounds are usually tested?
3.12. (-) Epinephrine exhibits 12-15 time more vasoconstrictor activity than (+) epinephrine, why?
3.13. Why valcyclovir is preferred over acyclovir?
3.14. Give structure & mechanism of action of baclofen.
3.15. Enumerate the phases in cancer cell cycle.

Q. No 4. Solve any five of the following sub-questions (Three marks each; max limit: 7 lines)

15 marks

4.1. Give a scheme of synthesis for Ibuprofen.
4.2. Give chemical classification of H_1- antagonists with suitable examples.
4.3. What are disappointments of QSAR?
4.4. Enlist various ways by which anti malarial drugs exert their action
4.5. Define the various terminologies used in synthon approach
4.6. Explain why penicillin G is orally inactive & ampicillin is orally active?
4.7. Explain the mechanism of action of alkylating agents.

Q. No 5. Solve any four of the following sub-questions (5 marks each; max limit: 15 lines) 20 marks

5.1. Explain the importance of enantioselectivity in drug metabolism with suitable examples.
21
5.2. Derive a general equation for kinetics of decay of radiopharmaceuticals.
5.3. Explain important points in Structure Activity Relationship of anabolic steroids.
5.4. Write short note on Receptor binding assay
5.5. Tetracycline undergoes ionization and exhibits three p Ka values at 3.3, 7.7 and 9.5. Write the structure and groups undergoing ionisation
5.6. Give planar & conformational structures of any two biologically active steroids representing one each to 5-α & 5-β cholestane type steroids.

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ANNEXURE-III

Model Question Paper for Ph. D Admission Entrance Test (Paper-II) in Pharmaceutical Sciences

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University of Pune *Paper code*

Faculty: Pharmaceutical Sciences **Subject & Subject code**: Pharmacology (PY03)
Date: Time: (Max. time for section-I:30 min.)

Instructions to the Candidates

a. All questions are compulsory
b. Answer book of section-I shall be collected at end of 20 minutes from the beginning of the examination.
c. Draw figures, sketches and diagrams where ever necessary.
d. Limit of lines for answers doesn' t apply when figures, tables and schematic diagrams are drawn as a part of answer.

SECTION-I

Q. 1.0: Solve all following sub-questions (One mark each) 20 marks

1.1. Molarity of simple syrup USP is
A) 5.8 B) 8.5 C) 4.7 D) 85
1.2. Complete mixing of magnesium stearate with tablet granules will
A) Decrease the crushing strength of tablets B) Increase tablet hardness
C) Increase tablet dissolution D) Increase tablet disintegration
1.3. Rate of elimination of drug from body is, if follows zero order kinetics, then it
A) is constant B) Depends on plasma concentration
C) Depends on type of metabolic pathway D) None of the above
1.4. 2, 2' , 2" , 2" ' - {[4, 8 dipiperidino (5, 4 -D) pyrimidino - 2, 6 - diyl}dinitrilo} tetraethanol is
A) Disopyramide B) Dipyridamole C) Dicyclomine D) Disulfiram
1.5. The parent nucleus present in the structure aconitine is
A) Benzazulene B) Imidazole C) Indole D) Piperidine
23
1.6. The malonic ester synthesis of barbital yields which of the following main form?
A) α-form B) β-form C) γ-form D) δ-form
1.7. Following receptors are membrane proteins, except
a) Receptors for fast neurotransmitters coupled directly to an ion channel
b) Receptors for many hormones and slow transmitters, coupled to effectors System
c) Receptors for insulin and various growth factors, which are directly linked to Tyrosine kinase.
d) Receptors for steroid hormone

1.8. Opoid receptors act via
a) Opening of potassium channels
b) Inhibition of calcium channels
c) Both (a) and (b)
d) Opening of sodium channels
1.9. $_1$- receptors are coupled with_____ G protein.
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c) Gq d) Go
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A) Soxhlet apparatus B) Clavengers apparatus
C) Supercritical fluid extractor D) Enfleurage
1.11. The amount of volatile oil in volatile oil containing plant is determined by using
A) Soxhlet apparatus B) Karl-Fischer apparatus
C) Clevenger apparatus D) Wildman trap flask
1.12. The chemicals which are coloured red when diluted tincture of alkane stains the cell walls are
A) Peptidoglycan, mucilage B) Cutin, suberin
C) Lignin, protein D) Starch, calcium oxalate
1.13. The C=O (aldehydic) bond shows characteristic stretching band at about
A) 1730 - 1700 cm-1 B) 2830 - 2695 cm-1
C) 1060 - 1275 cm-1 D) 1000 - 1200 cm-1
24
1.14. A Ramachandran plot shows _____
(A) The amino acid residues that have the greatest degrees of rotational freedom.
(B) The sterically allowed rotational angles between the side chain groups in a peptide and the peptide backbone.
(C) The sterically limited rotational angles (domains) where phi and psi are allowed in the protein backbone.
(D) The angles that are allowed about the bonds connecting the amide nitrogen in a peptide bond.
1.17. The neurotransmitter derived from tryptophan is
a. GABA b. Epinephrine c. Serotonin d. nor-epinephrine
1.16. Sterilization indicator used for ethylene oxide sterilization is
A) Bacillus osteoarthropathies B) Bacillus pumilus
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1.18. The patient suffering from complex partial seizures was treated for six months with carbamazepine, but recently, has been experiencing breakthrough seizures on a more frequent basis. You are considering adding a second drug to this patient' s anti-seizure regimen. Which one of the following is least likely to have a pharmacokinetic interaction with carbamazepine
A) Topiramate B) Tiagabine C) Levetiracetam D) Lamotrigine
1.19. The chi-square distribution always has … … .
A) Positive values B) Negative values
C) Positive and Negative Values D) None of the above
1.20. The paired T- test is used to compare … … .
A) Median B) Standard deviation C) Mean D) None of the above
25
SECTION-II
Q. No 2. Solve all following sub-questions (one mark each; max limit: 2 lines) 15 marks
2.1. Give the therapeutic indications of nitrites and nitrates.

2.2. What is OECD?
2.3. Name the gastric cytoprotective agent.
2.4 Which is the drug of choice for cerebral malaria?
2.5 Name the receptor on which morphine acts to produce analgesia?
2.6 Name the chemical antidote used in lead toxication?
2.7. Viscosity of solvent reduces signal width in NMR. True or false?
2.8. Name the exact strain of microorganism that is used in the production of plague vaccine?
2.9. What is the rationale of combining a beta adrenergic blocker and a diuretic with hydralazine?
2.10. Write normal range of fasting & post prandial blood sugar in human.
2.11. Name β adrenergic blockers used in asthamatics.
2.12. Why tetracyclines are not used in pregnant women?
2.13. Which drugs are used for treatment of grand mal epilepsy?
2.14. Name first line drugs for the treatment of tuberculosis.
2.15. Define immunosuppressants

Q. No 3. Solve all following sub-questions (Two marks each; max limit: 3 lines) 30 marks

3.1. Give the spectrum of activity of aminoglycoside antibiotic
3.2. What are the adverse effects of iron preparations when used as antianemic agent?
3.3. Give adverse effects of cyclosporine when used as immunosuppressant.
3.4. Explain the role 5HT-3 receptor blockers as antiemetics?
3.5. Why clonidine therapy is not abruptly stopped?
26
3.6. Explain epinephrine reversal?
3.7. Applying wood-word Fieser rule, calculate absorption max. for following compound
3.8. A drug is deemed to be spurious, if it contains any harmful or toxic substance which may render it injurious to heath, say true or false.
3.9. What is difference between one way & two way Anova?
3.10. State the temperature, pressure and time required to sterilize a plug of cotton in a hermetically sealed glass container by autoclaving?
3.11. Define bioassay. What are advantages of bioassay over chemical assay?
3.12. What are the advantages of Human insulin over animal insulin?
3.13. What are the limitations of *in-vitro* methods in testing of drugs?
3.14. How toxicity of anticancer drugs can be ameliorated
3.15. Enumerate various phases of clinical trials.

Q. No 4. Solve any five of the following sub-questions (3 marks each; max limit: 7 lines) 15 marks

4.1. What is the mechanism of action of amphetamine?
4.2. How does sucralfate act in ulcer?
4.3. Write the mechanism of action of retinovir?
4.4. What is role of edrophonium in myasthenia gravis?
4.5. Give the example of altered expression of proteins in drug resistant organism.
4.6. What is Lepra reaction?
4.7. What is the mechanism of resistance to rifampicin?

Q. No 5. Solve any four of the following sub-questions (5 marks each; max limit: 15 lines) 20 marks

5.1. Discuss animal models for screening of drugs for antiulcer activity.
5.2. Discuss metyrapone as adrenocorticoid biosynthesis inhibitors.
5.3 Give the mechanism of action of sitagliptin?
27
5.4 Discuss Cross Over Test Design in bioassay of insulin.
5.5. Explain limit test in Acute Oral Toxicity Testing of chemicals.
5.6. Why benzodiazepines are preferred over barbiturates?

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ANNEXURE-III

Model Question Paper for Ph. D Admission Entrance Test (Paper-II) in Pharmaceutical Sciences

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University of Pune *Paper code*

Faculty: Pharmaceutical Sciences **Subject & Subject code**: Pharmacognosy (PY04)
Date: Time: (Max. time for section-I:
30 min.)

Instructions to the Candidates

a. All questions are compulsory
b. Answer book of section-I shall be collected at end of 30 minutes from the beginning of the examination.
c. Draw figures, sketches and diagrams where ever necessary.
d. Limit of lines for answers doesn' t apply when figures, tables and schematic diagrams are drawn as a part of answer.

SECTION-I

Q. 1.0: Solve all following sub-questions (One mark each) 20 marks

1.1. Molarity of simple syrup USP is
A) 5.8 B) 8.5 C) 4.7 D) 85
1.2. Complete mixing of magnesium stearate with tablet granules will
A) Decrease the crushing strength of tablets B) Increase tablet hardness
C) Increase tablet dissolution D) Increase tablet disintegration
1.3. Rate of elimination of drug from body is, if follows zero order kinetics, then it
A) is constant B) Depends on plasma concentration
C) Depends on type of metabolic pathway D) None of the above
1.4. 2, 2' , 2" , 2" ' - {[4, 8 dipiperidino (5, 4 -D) pyrimidino - 2, 6 - diyl}dinitrilo} tetraethanol is
A) Disopyramide B) Dipyridamole C) Dicyclomine D) Disulfiram
1.5. The parent nucleus present in the structure aconitine is
A) Benzazulene B) Imidazole C) Indole D) Piperidine
1.6. The malonic ester synthesis of barbital yields which of the following main form?
29
A) α-form B) β-form C) γ-form D) δ-form
1.7. Following receptors are membrane proteins, except
a) Receptors for fast neurotransmitters coupled directly to an ion channel
b) Receptors for many hormones and slow transmitters, coupled to effectors System
c) Receptors for insulin and various growth factors, which are directly linked to Tyrosine kinase.
d) Receptors for steroid hormone
1.8. Opoid receptors act via
a) Opening of potassium channels
b) Inhibition of calcium channels
c) Both (a) and (b)
d) Opening of sodium channels
1.9. $_{1}$- receptors are coupled with_____ G protein.
a) Gs b) Gi
c) Gq d) Go
1.10. The apparatus recommended in BP for the hydrodistillation of volatile oil is known as
_____

A) Soxhlet apparatus B) Clavengers apparatus
C) Supercritical fluid extractor D) Enfleurage
1.11. The amount of volatile oil in volatile oil containing plant is determined by using
A) Soxhlet apparatus B) Karl-Fischer apparatus
C) Clevenger apparatus D) Wildman trap flask
1.12. The chemicals which are coloured red when diluted tincture of alkane stains the cell walls are
A) Peptidoglycan, mucilage B) Cutin, suberin
C) Lignin, protein D) Starch, calcium oxalate
1.13. The C=O (aldehydic) bond shows characteristic stretching band at about
A) 1730 - 1700 cm-1 B) 2830 - 2695 cm-1
C) 1060 - 1275 cm-1 D) 1000 - 1200 cm-1
30
1.14. A Ramachandran plot shows _____
(A) The amino acid residues that have the greatest degrees of rotational freedom.
(B) The sterically allowed rotational angles between the side chain groups in a peptide and the peptide backbone.
(C) The sterically limited rotational angles (domains) where phi and psi are allowed in the protein backbone.
(D) The angles that are allowed about the bonds connecting the amide nitrogen in a peptide bond.
1.18. The neurotransmitter derived from tryptophan is
a. GABA b. Epinephrine c. Serotonin d. nor-epinephrine
1.16. Sterilization indicator used for ethylene oxide sterilization is
A) Bacillus osteoarthropathies B) Bacillus pumilus
C) Bacillus subtilis var. niger D) Pseudomonas dimunata
1.17. If a drug is not labeled in a prescribed manner, it is deemed to be … … ..
A) Spurious B) Adulterated C) Substandard D) Misbranded
1.18. The patient suffering from complex partial seizures was treated for six months with carbamazepine, but recently, has been experiencing breakthrough seizures on a more frequent basis. You are considering adding a second drug to this patient' s anti-seizure regimen. Which one of the following is least likely to have a pharmacokinetic interaction with carbamazepine
A) Topiramate B) Tiagabine C) Levetiracetam D) Lamotrigine
1.19. The chi-square distribution always has … … .
A) Positive values B) Negative values
C) Positive and Negative Values D) None of the above
1.20. The paired T- test is used to compare … … .
A) Median B) Standard deviation C) Mean D) None of the above
31
SECTION-II
Q. No 2. Solve all following sub-questions (One mark each; max limit: 2 lines) 15 marks
2.1. How the bitterness value is expressed as per WHO guidelines.
2.2. Name the cryoprotectant used in cryopreserved tissue culture
2.3. Name the phytoconstituent from Guggul responsible for Anti-hyperlipedemic activity
2.4. Name the alkaloid belonging to yohimbine category
2.5. Name the precursor for the biosynthesis of phenanthrene alkaloids
2.6. What are important characteristic features of digitalis leaves?
2.7. What is m/z value for the parent peak of benzene?
2.8. Name the microorganism used in microbial assay in Vit B12?
2.9. Which enzyme is used for the isolation of protoplast from bacterial cell?
2.10. Name the Form number for issuing a certificate of renewal of license to sell, stock or exhibit or

offer for sale or distribute drugs.
2.11. What is significance of Killer-Killani Test?
2.12. Name cinchona alkaloid which gives blue florescence on treatment with conc. H_2SO_4
2.13. Name the typical plant auxin found in growing tissues
2.14. Name three amino acids precursors of hyoscyamine.
2.15. Name the essential ingredients used in the general preparation of plat tissue culture media.

Q. No 3. Solve all following sub-questions (Two marks each; max limit: 3 lines) 30 marks

3.1. Successive solvent extraction of crude drug with pet. ether, benzene, chloroform, ethyl alcohol
& water was performed. Quantitative chemical testing of pet. ether extract gave positive Kellar-Killani & Salkowski' s reaction. Ethyl alcohol extract & aqueous extract gave positive Ferric Chloride reaction and aqueous extract gave foamy solution.
a. Which constituents are present in petroleum ether / benzene extracts?
b. Which constituents are present in ethyl alcohol & aqueous extracts?
3.2. Write two commercial methods of extraction of ergot alkaloids.
3.3. What does the total ash value signifies and give the procedure to determine ash value?
32
3.4. Among the microscopial characteristics, the presence of different types of calcium oxalate crystals is an important diagnostic feature. Identify the correct type of calcium oxalate crystals present in the following drugs
A. Coca leaves
B. Atropa belladonna leaves
3.5. What is swelling power? What is pharmacopoeial limit of swelling power for Isapaghula husk IP?
3.6. What is procedure for determination of foreign organic matter in crude drugs as per IP
3.7. Give possible fundamental vibrations for polychromatic molecule?
3.8. What are three minimum conditions that need to be satisfied for an invention to be patentable?
3.9. Give principle of ELISA test.
3.10. What are labeling conditions for castor oil IP
3.11. How will you distinguish between Indian Podophyllum & American Podophyllum?
3.12. What are major phytochemical constituents of Canabis?
3.13. What is significance of Goldbeater' s skin test?
3.14. Chemically, what is natural campur? What is its biological source?
3.15. Define pre-biotics & pro-biotics?

Q. No 4. Solve any five of the following sub-questions (Three marks each; max limit: 7 lines) 20 marks

4.1. Give the difference between Alexandrian Senna & Indian Senna
4.2. What do you infer from the following observation? Answer in one sentence. "in the lycopodium
method for the determination of total length of fibres in a sample of cinnamon bark powder gave
27
to 40 to 50 per gram of air dried powder"
4.3. Explain 'Stas-Otto method' of isolation of glycosides?
4.4. What are the adulterants of Fox glove leaves and how they are detected?
4.5. Name the type of stomata present in following medicinal plants
i) Digitalis purpurea leaves ii) Datura Stramonium leaves iii) Cassia acutifolia
33
4.6. Following tests are performed in different samples of Natural Drugs. On the basis of given results, identify the class of chemical constituents
a. A thin section is treated with Tincture alkana- red colour obtained
b. An alcoholic extract of leaf is treated with Dragendroff' s reagent- raddish brown ppt
is obtained.

c. A pure orange colour product is dissolved in dry chloroform & treated with dry solution of antimony trichloride in chloroform.- Blue or bluish violate colour is obtained.

4.7. Explain in brief cultivation of *Papaver somniferum* and collection of its exudates.

Q. No 5. Solve any four of the following sub-questions (5 marks each; max limit: 15 lines) 20 marks

5.1. Explain the WHO guidelines for standardization of herbal drugs

5.2. Write general methods for extraction of volatile oils

5.3. Give the biosynthetic pathway of Atropine

5.4. What are applications of plant tissue culture in Pharmacognosy?

5.5. Explain in details Lycopodium spore method for quality control of crude drugs.

5.6. Name minimum three adulterants used in clove and explain how they are detected?

UNIVERSITY OF PUNE
Syllabus for M.Sc. Biochemistry (Credit System/Semester System) starting from June 2008

M.Sc. Biochemistry syllabus under credit system at the Department of Chemistry, University of Pune, Pune-411007 will be effective from the academic year 2008. The M.Sc. course in Biochemistry for two years will consist of 100 credits and will have 70 credits for theory and 30 credits for practical and project work. Each semester will run for 15 weeks. Each credit is equivalent to 15 clock hours of teaching.

Semester I Theory Courses Credits

B CH 170 Biomolecules 5

BCH 171 Enzymology and Physiological Biochemistry 5

BCH 172 Cell Biochemistry 5

Semester II Theory Courses

BCH 270 Bioenergetics and Metabolism 5

BCH 271 Biophysical Techniques 5

BCH 272 Biostatistics Bioinformatics and Computational techniques in Biochemistry 5

BCH 273 Membrane Biochemistry and Nucleic acid 5

Practical Courses for Part I

BCH 167 Analytical Biochemistry I + II 5

BCH 168 Biophysical Techniques and Computers 5

BCH 267 Microbiology and Enzymology 5

* *The teacher can take liberty of introducing latest topics in the respective field. The teacher should also provide sufficient reading material to the student for such new topics/concepts being taught in the classroom*

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M.Sc. Biochemistry Part I Syllabus

SEMESTER I

BCH –170 Biomolecules

Biomolecules I: Carbohydrates and Lipids

1 The molecular logic of life: The chemical unity of diverse living organisms, composition of living matter. Macromolecules and their monomeric subunits.

2 Properties of Water: With interactions in aqueous systems. Ionization of water, weak acids and weak base. The pH scale, measurement of pH, pH metry, acid base titration curves. Buffers, biological buffer systems.

3 Carbohydrates: Classification, basic chemical structure, monosaccharides, aldoses, and ketoses, cyclic structure of monosaccharides, steroisomerism, anomers and epimers. Sugar derivatives, deoxy sugars, amino sugars, and sugar acids. General reaction and properties.

4 Lipids: Classification, structure and function of major lipid subclasses-acylglycerols, circulating lipids, Separation techniques Lipoproteins, chylomicrons, LDL, HDL, and VLDL. Pathological changes in lipid levels. Formation of micelles, monolayers, bilayer, liposomes.

5 Vitamins and Co-enzymes: Classification, water-soluble and fat-soluble vitamins. Structure, dietary requirements, deficiency conditions, coenzyme forms.

Biomolecules II: Proteins

1. Amino acids: Classification, Properties, reactions, rare amino acids, and separation techniques.
2. Protein classification: Reactions, functions, properties peptide synthesis. Solid phase synthesis.
3. Structure:

a) Peptide bond, end group analysis, sequencing.
b) Secondary: X ray diffraction, alpha-helix bets- structure, β-helix, super secondary structure.
c) Tertiary Structure: Forces stabilizing, unfolding/ refolding expt. Prediction of tertiary Structure.
d) Quaternary structure – hemoglobin.
e) Ramachandran plot.
f) Helix coil transitions, Vander Walls, electrostatic, Hydrogen bonding, and hydrophobic interactions.
g) Energy terms in Biopolymer conformational calculation.

Reference Books:

1 Principles of Biochemistry, Lehninger C Rs. Publ. (1982).
2 Biochemistry, L. Stryer, W.H. Freeman, San Francisco.
3 Schaum's Outline Series of Theory and Problems of Biochemistry, Philip W. Kuchel and G.B. Ralston. Int. Ed., McGraw-Hill Book Co.
4 Problem Approaches in Biochemistry. Wood and Hood.

3

BCH 171 Enzymology and Physiological Biochemistry

Enzymology

1. Historical aspect: Remarkable properties cofactors Nomenclature and classification, isoenzymes, multienzyme.
2. Isolation, purification, criteria's of purity.
3. Enzymes kinetics: One substrate reactions, effect of pH, temperature and inhibitions. Two substrate reactions. Theory, order analysis, pre-steady state kinetics, stopped flow technique, Relaxation methods.
4. Mechanism of enzymes action: Theoretical background, Factors leading to rate enhancement of enzyme catalyzed reactions: Acid-base catalysis, proximity and orientation effects, covalent catalysis, strain or distortion and change in environment. Experimental approaches of determination of enzymes mechanism: Kinetics studies, detection of intermediates, X-ray crystallographic studies, Chemical modification of amino acid side chain and affinity labeling, site directed mutagenesis. Examples of chymotrypsin, triose phosphate isomerases, aldolase etc.
5. Control of enzyme activity: Control of activities of single enzyme: inhibitor molecules, availability of substrate or cofactor. Product inhibition. Control by changes in covalent structure of enzymes:

a) Reversible Change
b) Irreversible change

6. Zymogen activation and phosphorylation dephosphorylation ligand induced changes: Allosteric enzymes, Therotical models, Hill equation, Adair equation, M.W.C. and K.N.F. Models, usefulness of the models. Significance of allosteric and cooperative behavior in enzymes.
7. Control of metabolic pathways: Amplification of signals, substrate cycles and Interconvertible enzyme cycles.
8. Multienzyme complex: Properties, pyruvate dehydrogenase system, (*E. coli* and mammalian), Tryptophan synthetase, multienzyme complex from E.coli, fatty acid synthetase, glycogen particle.
9. Enzyme turnover: Kinetics of enzyme turnover. Measurement of enzyme turnover, Ks

and Kd. Correlation between the rates of enzyme turnover and structure and function of enzymes. Mechanism of enzyme degradation. Significance of enzyme turnover.
10. Clinical aspects of enzymology: LDH isozymes, SGOT, SGPT, creatine kinase, alpha amylase, phosphatase, inborn errors.
11. Ligand binding

Physiological Biochemistry:

1. Blood: Blood composition, plasma proteins and their diseases, blood counting and its significance, leucocyltes, thrombocytes and erythrocytes.
2. Chemistry of respiration: Gas transport and pH regulation, need for a carrier of oxygen in blood, transport of oxygen, carbon dioxide and H by Hb, buffer systems of plasma, interstitial fluid, carbon dioxide-bicarbonate buffer system, acid- base balance and it's maintenance, compensatory mechanisms, measures of acid base imbalance, significance of Anion gap.
3. The kidney: Formation and acidification of urine, abnormalities of acid- base balance regulation by kidney, mechanism of action of diuretics, tests of renal function, composition of urine and hormones of the kidney.

4

4. Water and mineral metabolism.
5. Liver function and its disorders.

Reference Books:

1. Text-book of Biochemistry with clinical correlations by Thomas M. Devlin, 2nd Edition, J. Wiley and Sons (1986).
2. Physiological chemistry by Harper.
3. Textbook of Medical Physiology by Guyton. A.C., H. Sanders Philadelphia. 1988.
4. Physiological basis of Medical practice, West J.B., Best and Taylor.
5. Introduction to Physiology by Davidson H and Segal M.B. Academic Press.
6. Fundamentals of Enzymology by Price and Stevens
7. Enzymology by Dixon and Webb
8. Enzymes by Palmer

BCH 172 Cell Biochemistry

Cell Biochemistry I

1. Characterization and classification of microorganisms.
2. Theory, phase contrast microscopy, fluorescence microscopy.
3. Electron microscopy: theory, specimen preparation, freeze etching, freeze fracture, shadow casting, electron microscopy of nucleic acids, TEM, SEM.
4. Cell wall: Structure of peptidoglycon and other cell wall components.
5. Cultivation of Bacteria, nutrition, physiology and growth of microbial cells.
6. Reproduction and growth, synchronous growth, continuous culture of microorganisms.
7. Pure cultures and cultural characteristics.
8. Fundamentals of control of microbial growth, control by physical agents, control by chemical agents.
9. Production of mutants by chemical and physical agents and their characterizations.
10. Host Microbe Interactions, endotoxins, exotoxins, capsular material. Enzymatic and other factors, tissue affinity, resistance and immunity.
11. Viruses of bacteria, plant and animal cells, structure classification life cycle, Mycoplasma and viriods, diseases
12. Chemical activities of bacteria leading to the accumulation of industrially important products.

Reference Books :

1. Microbiology, M.S. Pelczar, R.D. Reid, E.C.S. Chan, Mc Graw Hill, New York (1986).
2. General Microbiology (Vth Edition), R.Y. Stanier, Prentice Hall (1986)
3. Biochemical Engineering, S Aiba, A.E. Humphrey, Nancy F. Mills, University of Tokyo Press. (1978).

4. Introductory Microbiology, F.C. Ross, Charles Merril Publication (1983).

Cell Biochemistry II

Cell classification, cell variability, size, shape and complexity, function
Prokaryotes, cell structure and components
Eukaryotic cell : Structure, sub cellular components: Nucleus, chromosomes, plasma membrane, cell wall, endoplasmic reticulum, lysosomes, peroxisomes, Golgi apparatus,
5
mitochondria, chloroplast, cytoskeleton, pili, flagellum, sub cellular fractionation, different and density gradient centrifugation, specific staining of organelles or marker enzymes.
Cell division, mitosis and meiosis, cell cycle
Plant cells: Cell wall and its function, xylem, phloem and epidermal cells. The interaction and communication between the cells, cell-cell reorganization in plants, role of golgi vesicles in plasma membrane, cell growth and division.
Cell-cell adhesion and the extracellular matrix-species Intercellular recognization specific cell aggregation in sponges, cell junctions, extracellular matrix, collagen, elastic fibronectin
Germ cells and fertilization stem cells, cell differentiation, organogenesis, functional and biochemical maturation of tissues.
Molecular basis of biodiversity

Reference Books:

1. Molecular Biology of the cell – Bruce Alberts – J.D. Watson et al Garland publishing Inc., N.Y. (1983).
2. Cell and Molecular Biology – DeRobertis and Saunders (1980).
3. The cell – C.P. Swanson, Prentice Hall (1989)
4. Cell Biology – C.J. Avers, Addision Wesley Co. (1986).

SEMESTER II

BCH: 270 Bioenergetics and Metabolism

Bioenergetics and Metabolism I

1. Survey of metabolism: Carbon, oxygen, nitrogen cycle catabolism, use of mutants and isotopes in the study of metabolism, compartmentation, food chain and energy flow.
2. Cell bioenergetics: First and second law of thermodynamic, internal energy, enthalpy, entropy, concept of free energy, standard free energy change of a chemical reaction, redox potentials, ATP and high energy phosphate compounds.
3. Glycolysis: Anaerbic pathway of glucose metabolism, two phases of glycolysis. Detailed study of all the reactions, entry of other carbohydraes in Glycolytic pathway, energy balance sheet regulation of glycolytic sequence by enzymes and hormones, alcoholic fermentation.
4. Citric acid cycle: Aerobic pathway of glucose metabolism, historical background, details of the cycle, use of isotope for the study of citric acid cycle, interconversion of hexoses, Pasteur Effect.
5. Alternate pathways of carbohydrate metabolism: Pentose phosphate pathway, glyoxalate cycle, glucuronic acid cycle, inter conversion of hexoses, Pasteur effect.
6. Lipid metabolism: Fatty acid metabolism, Beta oxidation of saturated and unsaturated fatty acids, the phases of fatty acid oxidation, energetics of beta oxidation. Oxidation of fatty acids with odd number of carbon atoms, formation of ketone bodies, other types of fatty acid oxidation.
7. Integration of carbohydrate and lipid metabolism.
8. Biosynthesis of lipids: Requirements of carbon dioxide and citrate for biosynthesis, fatty acid synthase complex, regulation of biosynthesis. Biosynthesis of triglycerides, cholesterol and phospholipids.
6
9. Electron transport chain and oxidative phosphorylation.

10. Glycogen metabolism: Biosynthesis and degradation of glycogen and it's regulation. Starch and cellulose biosynthesis.
11. Gluconeogenesis
12. Photosynthesis : Intracellular organization of photosynthetic system, fundamental reactions of photosynthesis, light and dark reactions, photosynthetic pigments, role of light, Hill reaction and it's significance. Photophosphorylation, light reactions, cyclic and non-cyclic photoinduced electron flow, energetics of photosynthesis, photosynthetic phosphorylation photorespiration, dark phase of photosynthesis, Calvin cycle, C4 pathway, Bacterial photosynthesis.

Metabolism II: Nitrogen Metabolism

1. Oxidative degradation of amino acids : Proteolysis, Transamination, oxidative deamination, acetyl CoA, Alpha ketogutarate, acetoacetyl CoA, succinate, fumarate and oxaloaccetate pathway, decarboxylation, urea cycle, Ammonia excretion.
2. Biosynthesis of amino acids: Amino acid biosynthesis, Precursor functions of amino acids, Biosynthesis of aromatic amino acids, Histidine, One carbon atom transfer by folic acid (Biosynthesis of glycine, serine, cysteine, methionine, threonine.)
3. Peptides, polyamines, Porphyrins, gamma glutamyl cycle, glutathione biosynthesis, Nonribosomal Protein Biosynthesis.
4. Purine pyrimidine degradation.
5. Biosynthesis of Purine and pyrimidine nucleotides, Regulation, Biosynthesis of nucleotide coenzymes.
6. Nitrogen fixation: historical background, nitrogen cycle in nature, symbiotic nitrogen fixation, nitrogenase system, nitrate reductase.

Reference Books

1. Biochemistry – Lehninger.
2. Metabolic Pathways - Greenberg.
3. Biochemistry – G. Zubay, Addision Wesley Publ. (1983).
4. Biochemistry – Stryer (1988) 3rd Edition W.H. Freeman and Co.

BCH – 271 Biophysical Techniques

Biophysical Techniques I

1. UV and visible Spectophotometry, IR and NMR Spectrophotometry.
2. Membrane filtration and dialysis: Nitrocellulose, fibre glass, Polycarbonate filters, Dialysis and Concentration, Reverse Dialysis, Freeze drying, lyophilization.
3. Chromatography: Partition and adsorption Chromatography- paper, TLC, GLC, GCMS, Gel filtration-theory, materials, advantages, molecular weight determination and other applications. Ion exchange chromatography – properties of ion exchangers, choice, technique and applications. Amino acid analyzer- HPLC, HPTLC, affinity chromatography Methods of ligand immobilization. Immuno-adsorption – Hydrophobic interaction chromatography, Metal chelate chromatography, covalent chromatography. Special chromatographic techniques for nucleic acids. DNA cellulose chromatography, MAK hydroxyl-apatite chromatography, Separation of DNA fragment according to their base composition.

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4. Electrophoresis : Theory, types, moving boundary electrophoresis, zone electrophoresis, paper, cellulose acetate, gel Electrophoresis, Native PAGE, disc PAGE, Gradient PAGE, SDS PAGE, DNA agarose gel electrophoresis Southern, Northern, Western transfers, Isoelectric focusing finger printing, DNA sequencing Pulsed – field Electrophoresis, Capillary Electrophoresis.

Biophysical Techniques II

1. Sedimentation: Theory, Preparatory and analytical ultracentrifuges, factors affecting sedimentation velocity, sedimentation coefficient, measurement of S, Zonal centrifugation, DNA analysis, Determination of molecular weight by sedimentation, diffusion and sedimentation equilibrium methods. Specific example of application.

2. Partial specific volume and the diffusion coefficient, Measurement of partial specific volume and diffusion coefficients.
3. Viscosity: Theory, effect of macromolecules on the viscosity of a solution, measurement, molecular weight determination.
4. Isotope Tracer Technique: Types of radiations, measurement scintillation and gamma counters. Background noise quenching, Applications.
5. Interaction of radiation with matter, passage of neutrons through, matter, interaction of gamma rays with matter, units of measuring radiation absorption, Radiation dosimetry, Radiolysis of water, free radicals in water.
6. Autoradiography.

Reference Books:

1. Physical Biochemistry by D. Freifelder IInd Edition (1982)
2. Biochemical calculation by I.H. Segal IInd Edition (1976)

BCH-272 Biostatistics Bioinformatics and Computational techniques in Biochemistry

Biostatistics:

Principles and practice of statistical methods in biological research, samples and populations, Basic statistics-average, statistics of dispersion, coefficient of variation, confidence limits, Probability distribution, normal, binomial and Poisson distribution. Mean variants, standard deviations and standard error, correlation and regression, test of statistical significance, and analysis of variance.

Computational techniques in Biochemistry

Introduction to hardware and software, binary and decimal numbers, constants and variables, assignment statement, flow charts and their use. If and go to statements, Do loops. Input, output and format statements, Subroutines and function subprograms. Introduction to programming in BASIC/Fortran/C. The students will carry out programming in a related laboratory course.

1. Computer awareness
2. Basic programming
3. Writing of few basic programs related to Biochemistry
4. Prentice on packages
5. Writing a BASIC program to plot graphs of enzyme kinetic data by a variety of linear transforms and the Michalies Menten hyperbolic plots.
6. Write a BASIC program to calculate the pH of a dilute salt solution
8
7. Write a BASIC program for the analysis of amino acid sequences.
8. Use of packaged statistical computer program for the statistical analysis.
9. Use of computer program to analyze DNA sequences to find complementary sequences, search repeats, restriction sites, coding sequences, codon usage, etc

Reference Books:

1. Computers and Common Sense- *R. Hunt and Shelley*, Prentice Hall, New Delhi (1998).
2. Computer Programming in Fortran-90- *V. Rajaraman*, Prentice Hall, New Delhi (1990).
3. Computing for Biologists- *A. Fielding*, Addison Wesley Pub., UK (1985).
4. Microcomputers in Biochemical Education- *E. J. Wood (Ed)*, Taylor and Francis Ltd., UK (1984).
5. Computer Games and Simulation for Biochemical Engineering- *H. R. Bungay*, John Wiley and Sons Ltd., New York (1985).
6. Microcomputers in Biology- A practical approach- *C. R. Ireland and S.P. Lang*, IRL Press Ltd., (1985)

BCH 273 Membrane Biochemistry and Nucleic acid

Membrane Biochemistry

1) Biological membrane, structure, and assembly: constituents, bacterial cell envelope, asymmetry flip flop, protein lipid interaction, factors affecting physical properties of membranes.

2) Membrane models: biological and physical models: energetics and transduction phenomena, biochemical chemiosmotic hypothesis of Mitchell.
3) Membrane transport: diffusion, passive, active and facilitated, transport role of proteins in the process, exocytosis, receptor mediated endocytosis, osmoregulation.
4) Na, H dependent processes and phosphotranferase synthesis, specialized mechanism for transport of macromolecules, gap junctions, nuclear pores, toxins, control of transport processes, binding proteins, hormone effects and the role of lipids.
5) Role of Na, K ATPase and the passive permeability of the plasma membrane to Na, K and Cl, voltage and ligand gated ion channels, ATP-ADP exchanger.
6) Molecular mechanisms, ion translocating antibiotics, valinomycin, gramicidin, ouabain, group translocation, ionophores, electrical gradient, energy coupling mechanism.
7) Penetrating the defenses: how antimicrobial agents reach their targets, cellular permeability barrier to drug penetration, some examples of modes of penetration of antimicrobial agents, the exploitation of transport systems in the design of new antimicrobial agents.
8) Assembly of virus membrane receptor

Nucleic Acids

1. Molecules of Heredity: Structure of DNA and RNA, DNA as genetic, material, Double helix. Semi conservative mechanism of replication. Nearest neighbor analysis. Denaturation and renaturation A, B, and Z forms of DNA.
2. Nearest neighbor analysis, Denaturation and renaturation, A, B and Z forms of DNA.
3. Laws of Haredity : Genotype, Phenotype Mendelian Laws of inheritance.
4. Basis of Biochemical genetics: One gene one cistron complementation tests, Co-linearity.
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5. Auxotroph, prototroph, conditional mutants, Mutant isolation and selection. Transformation. Conjugation, Transposition.
6. Sex factors and Plasmids: Fertility factor, Hfr, Mapping of E, coli chromosome, other plasmids, cosmids, Introduction to Operon.
7. Genetic Code: Biochemical and genetic analysis of the genetic code.
8. Bacteriophages: Life cycle, use of bacterial viruses in genetic studies.
9. Genetic disorders, of chromosomal origin, gene origin –mutation.
10. Specialized genetic systems of fungi: Tetrad Analysis.

Reference Books:

1. Biochemistry of antimicrobial action- 4th edition, Chapman and Hall , TJ Franklin and GA Show (BCL)
2. Biochemistry-G Zubay , Addison Wesley, 1983
3. Biochemistry, L Stryer, 3rd/4th/5th ed, 1989 , Freeman and Co. NY
4. Principles of Biochemistry –Lehninger
5. Biochemistry with clinical correlation- Thomas Devlin, 2nd ed, John Wiley and sons
6. Membranes and their cellular functions- IB Filnean, R.Coleman and RH Michell, 1984, Blackwell scientific publishers, Oxford, 3rd ed.
7. Genetics – Strickberger M.W., Macmillan Pub;. Inc. (1976).
8. 36 Lectures in Biology – S.E. Luria, M.I.T. Press, Cambridge (1975).
9. The Genetics of Bacterial viruses – William Hayes, PBS Publ. (1984).
10. Molecular Biology of the Gene- Watson Benjamin / Cummings Publ. Company (1987).
11. Genetics Analysis and Principles: R.J. Brooker Addison-Wesley.

BCH 167 Analytical Biochemistry I and II

1. Amino acid detections (Paper chromatography) and estimations.
2. Comparative evaluation of different methods of protein analysis: Lowry, Biuret, Kjeldahl, UV.
3. Specific reactions for Carbohydrate and estimations.
4. Isolation of amino acid and proteins: cystine, Egg albumin, globulin, milk casein .
5. Starch preparation and characterization.

6. Alpha and Beta amylolysis.
7. Cholesterol and lecithin from egg.
8. Vitamin C estimation.
9. Lipid isolation detection and estimations.
10. Estimation of DNA by diphenylamine method
11. Estimation of RNA by orcinol method

Reference Books

1. Practical Biochemistry: Principles and techniques: K. Wilson and J. Walker.
2. Practical Biochemistry by David Plummer
3. Introductory Practical Biochemistry by S.K. Sawhney and R.Singh.

BCH 168 Biophysical Techniques and Computers

Biophysical Techniques

1. Concept of pH, preparation of buffers, measurement of pH.
2. pH metry: Acid base titration curves. Measurement of pKa of amino acids.

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3. Ion exchange chromatography: Nature of exchanger, capacity of column, Separation of amino acids.
4. Gel filtration: Determination of void volume, Determination partition coefficient, Separation of two components in a sample.
5. Viscosity: Viscosity of hydrolyzed, partially hydrolyzed and unhydrolyzed starch. Determination of relative viscosity, Specific viscosity and intrinsic viscosity.
6. Electrophoresis: Paper electrophoresis, Agar electrophoresis for separation f low mol. Wt. Dyes. Separation serum proteins by Agarose gel electrophoresis. Polyacrylamide Gel electrophoresis (PAGE). Single cell electrophoresis
7. UV and Visible Spectrophotometry: Absorption spectra, Demonstration of Beer's Law, UV absorption of proteins and amino acids, Determination of Molar extinction coefficient. Absorption spectra of hemoglobin derivatives – oxyhemoglobin, carboxyhemoglobin and methemoglobin.
8. Dialysis, reverse dialysis and membrane filtration.
9. High performance Liquid Chromatography (HPLC)
10. Osmotic fragility.
11. Measurement of Refractive Index.

Reference Books:

1. An introduction to practical Biochemistry – David T. Plummer, Tata Mc Graw Hill Co. Ltd., Bombay.
2. Introductory Practical Biochemistry (2001). Ed. S.K. Sawhney and Randhir Singh.
3. Practical Biochemistry Sadasivam and Manickam.
4. Practical Biochemistry, Principles and Techniques (1995). Ed. Keith Wilson and John Walker.

Computer Programming

The student is expected to write and execute at least six of the following or similar computer programs in BASIC/Fortran/C

1. Linear regression
2. Quadratic equation
3. Simulation of pH titration
4. Michaelis Menten enzyme kinetics
5. Analysis of amino acid sequences
6. Analysis of DNA sequences, Complementary sequences, repeat frequencies, etc
7. Handling of atomic co-ordinates, files and distance statistics in large molecules
8. Determination of number of covalent or weak bonds from the given atomic co-ordinate files of a protein molecule.

These programs are only indicative. The instructor may choose other programs to illustrate the use of computers in chemistry.

Reference Books :

1. Computers and Common Sense- *R. Hunt and Shelley*, Prentice Hall, New Delhi (1998).
2. Computer Programming in FORTRAN-90- *V. Rajaraman*, Prentice Hall, New Delhi (1990).
3. Computing for Biologists- *A. Fielding*, Addison Wesley Pub., UK (1985).
4. Microcomputers in Biochemical Education- *E. J. Wood (Ed)*, Taylor and Francis Ltd., UK (1984).

11

5. Computer Games and Simulation for Biochemical Engineering- *H. R. Bungay*, John Wiley and Sons Ltd., New York (1985).
6. Microcomputers in Biology- A practical approach- *C. R. Ireland and S.P. Lang*, IRL Press Ltd., (1985)

BCH 267 Microbiology and Enzymology

Microbial Techniques

1. Media preparation, pour plate and streak plate techniques,
2. Microscopic examination (motility, monochrome staining and gram staining).
3. Sterilization: Steam, Dry heat and filter.
4. Detection of amylase, caseinase, catalase activity
5. Preservations of bacterial cultures.
6. Phosphatase test for the quality of milk
7. Methylene blue reduction test (MBRT) for quality of milk
8. Growth curve of *E. coli*.
9. Growth curve of yeast.
10. Total viable count determination (pour plate and spread plate).
11. Ultraviolet irradiation and survival curve.
12. Isolation of auxotrophic mutants.
13. Plaque assay for phage.
14. Immobilization of yeast cells
15. Alcohol production.
16. BOD
17. COD.
18. Microbial, assay of vitamin and antibiotic.

Reference Books :

1. Microbial methods – J.Collins.
2. Medical Microbiology, Vol. II – Cruickschank.

Enzymology

1. Detection of some common enzymes.
2. Effect of different parameters on enzyme activity
3. Enzyme Kinetics (Determination of Km and Vmax)
4. Purification and characterization of enzyme
5. Enzyme immobilization.

Reference Books:

1. Biochemical Techniques Theory and Practice: J.R. Robyt and B.J. White.
2. Practical Biochemistry: Principles and techniques: K. Wilson and J. Walker.
3. Practical Biochemistry by David Plummer
4. Introductory Practical Biochemistry by S.K. Sawhney and R.Singh

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M.Sc. Biochemistry Part II- Syllabus

Semester III Theory Courses Credits

B CH 370 Molecular Biology 5
BCH 371 Medical Biochemistry and Immunology 5
BCH 372 Signal transduction pathways 4

Optional Courses (Any One)

BCH 373 Recent trends in Biochemistry and Toxicology 5
BCH 374 Developmental Biology and Molecular Evolution 5
BCH 375 Nutrition and Clinical Nutrition 5

Semester IV Theory Courses

BCH 470 Biochemical Endocrinology and Tissue culture 4
BCH 471 Fermentation, Enzyme and Food Technology 4
BCH 472 Genetic Engineering 4

Optional Courses

BCH 474 Genomics and Biotechnology 4

Practical Courses for Part II

BCH 367 Molecular Biology and Clinical Biochemistry 5
BCH 368 Special Experiments 3
BCH 467 Project 7
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Semester III

BCH 370 Molecular Biology

1) DNA Replication: DNA polymerase I, II, III, origin locus, Okazaki fragments, replication fork.
2) DNA Repair: substitution, deletion and insertion mutations, pyrimidine dimer, uracil DNA glycosidase.
3) Gene rearrangements recombination, Holliday structures, rec A,B,C,D. SOS response, mobile genetic elements
4) Transcription and splicing :RNA polymerases, promoters, sigma and Rho factors, initiation, elongation and termination of transcription, post transcriptional modifications of tRNA and rRNA, inhibitors of transcription, RNA pol I,II,III, enhancers ,5' capping, 3' poly A tailing, splice site, mechanism of splicing, ribozyme.
5) Protein synthesis
6) Protein targeting: Intracellular protein targeting. Signal hypothesis, signal sequences, glycosylation, Targeting of protein to mitochondria, lysosomes, ER, plasma membrane, Peroxisomes, chloroplast, destruction of proteins, etc
7) Protein folding and protein motifs and control of gene expression
8) Eukaryotic chromosome and gene expression
9) Molecular virology

Reference Books

1) Biochemistry (3rd /4th/5th edition) L. Stryer, WH Freeman and Co.
2) Molecular biology of the gene, Vol I and II (4TH ed)J D Watson, Benjamin/Cummings publ. Co Inc.
3) Molecular cell biology (1988) J Darnell and D. Baltimore, W,H Freeman and Co.
4) Molecular biology of the cell (19830 B. Alberts, Garland Pub. In., NY
5) Genes (2nd ed), B. Lewin, John Wiley and sons, NY.

BCH 371 Medical Biochemistry and Immunology

Medical Biochemistry

1) Mechanism of action at molecular level of selected antibiotics, anti metabolites, analgesics, hallucinogens and other drugs, mechanism of resistance to antibiotics and other drugs.
2) Lysosomes and their physiological role.
3) Cerebrospinal fluid, composition in health and disease.
4) Blood coagulation, clotting factors, mechanism of coagulation, fibrinolysis, abnormal hemoglobin's, fibronectins. Diseases of cardiovascular system.
5) Cancer causative agents and control theories of cancer and carcinogenesis, viral etiology, control of cancer and carcinogenesis, viral etiology, control of cancer –basic approaches.
6) Counseling for genetic diseases
7) Ageing and apoptosis

Reference Books

1) Biochemistry of antimicrobial action (4th ed) TJ Franklin, Chapman hall (1989)
2) General Microbiology, Pelczar, Rard and Chan (1987)

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3) Mechanism of microbial diseases, M Schaechter et al,Williams and Wilkino Int. Ed.(1989)
4) Biochemistry, L Stryer (3rd ed), Freeman and Co.
5) Textbook of Biochemistry with clinical correlations, Thomas Devlin,(2nd ed),John Wiley and sons
6) Biochemical aspects of human diseases (1983), RL E lkeles, Slackwell scientific publishers, Oxford
7) Analogues of nucleic acids, Ray Berman (1970), Springer Verlag.

Immunology

1) Cellular basis of immunity: immunological memory, specificity, diversity, discrimination between self and non self, primary and secondary lymphoid organs, cell mediated and humoral immune responses, T and B lymphocytes, autoimmune reactions.
2) Antigen and antibody: antigen, antigenic determinant, immunopotency, structure of antibody, constant and variable regions, Fab, F(ab2) and Fc fragments, different classes of antibodies and their functions, fine structures of antibodies, X ray diffraction studies, isotypes, allotypes and idiotypes,
3) Measurement of antigen- antibody interaction, diffusion, immunodiffusion, immunoelectrophoresis, radioimmunoassay, immunoflorescence, ELISA, Western blotting
4) Clonal selection theory of antibody production, monoclonal and polyclonal antibodies, poly reactive antibodies, catalytic antibodies, abzymes.
5) Complement system: classical and alternate pathway
6) T lymphocytes and cell mediated immunity, T cell sub populations, immune response genes, MHC gene complex, polymorphism, graft rejection, graft versus host response
7) Hypersensitivity, immunodeficiency diseases
8) Vaccines, interferon, AIDS
9) Blood antigens: blood group substances and Rh factor

Reference books

1) Molecular biology of the cell –Garland publishing Inc., NY, London
2) Immunology 3rd ed Janis Kuby
3) Essentials of immunology (5th ed) Roit, Blackwell scientific publishing, London
4) Cellular and Molecular Immunology, 3rd ed, Abbas

BCH 372 Signal transduction pathways

Signal transduction pathways I

1) Muscle contraction and cell motility: skeletal muscle, structure of muscle cell, ultra structural organization, protein components of myofibrils, molecular organization of thick and thin filaments, mechanism of muscle contraction, metabolism of muscle, cardiac muscle contraction, regulation of contraction, contractile proteins in cells other than muscle filaments, microfilaments, microtubules, cilia and flagella of eukaryotic cells,
2) Nerve conduction: structure and composition of nervous tissue, creation and propagation of nerve impulses, action potential, sodium and potassium channels. Transmission of nerve impulse, colinergic receptors, acetyl choline receptors, electraplexus as a source of acetyl choline receptors, acetyl choline esterase, nerve poisons, other neurotransmitters.

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3) Biochemistry of vision: Structure of eye, lens and retina, perception of light, rods and cones, rhodopsin, primary events in visual excitation, cyclic GMP and transduction in generation of nerve impulses, color vision.
4) Biochemistry of taste and smell.
5) Biochemistry of hearing and speech

6) Chemotaxis.

Reference Books

1) Biochemistry , L Stryer, Freeman and Co, NY
2) Biochemistry, Zubay, Addison Wesley and Co.
3) Textbook of Physiology, Guyton
4) Physiology, Berne and Levy

Signal transduction pathways II

1) Neuromorphology and neuroanatomy- Central nervous system, spinal cord and different regions of the brain, peripheral nervous system, afferent pathways and sense organs, afferent pathway
2) Nerve and synapse structure, structure-function correlation at the synapse, transmission across the synapse, membrane potential in the steady state, action potential generation and propagation
3) Sensory system: types of receptors, properties, sensory modalities and sensory circuits. Sensory perception
4) Chemical composition of the brain
5) Specific aspects of carbohydrate, protein, lipid and amino acid metabolism in the brain
6) Neurotransmitter metabolism
7) Neuropeptides –turnover and regulation
8) Cerebro-spinal fluid, blood brain barrier
9) Coordination between nervous and endocrine systems
10)Natural, genetic & environmental factors affecting the development of CNS
11)Neural plasticity learning
12) Localization of higher functions: EEP patterns
13) Calcium signaling, zinc fingers

Reference books

1) Text book of physiology- Guyton
2) Principles of neural science Kandel ER, Schwartz JH, Elsevier, N. Holland, NY
3) Neurobiology, Shepherd GM , Oxford Univ. Press
4) Nerve and muscle excitation Junge D, Sinauer assoc, Sanderland, mass

BCH 373 Recent Techniques in Biochemistry & Toxicology

Recent Trends in Biochemistry

1. Basic concepts of theoretical conformation analysis of proteins
2. Spectroscopic methods:

a. NMR
b. ESR,
c. Fluorescence
d. ORD, CD.

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e. GCMS

3. Biosensors
4. Electron spray assisted ionization
5. LCMS, MALDI, MALDI-TOF
6. IPR: Patent and Patenting, Intellectual right protection (National & International), WTO regulations.

Reference books

1) Biochemistry L Stryer, 4th ed
2) Molecular biology of the gene, Watson
3) Fundamentals of Biochemistry, Donald Voet, Judith Voet, Charlotte W Prott.
4) Molecular Cell Biology, 4th ed, Lodish Berk, Zipursky Matsudaira, Ball.
5) Physical Biochemistry-Friefelder , 2nd ed, Freeman Pub.

Biochemical Toxicology

1) Environmental pollution

2) Evaluation of toxicity
3) Toxicity of pesticides, food additives, animal and plant toxins, industrial chemicals and heavy metals
4) Metabolism of toxic substance
5) Toxic responses of different tissues and organs
6) Occupational health and industrial toxicity
7) Regulation of safety and social aspects in relation to toxicants
8) Applications of toxicology: forensic, clinical
9) Control of environmental pollution

Reference books

1) Haye's principles and methods of Toxicology Ed. A Wallace Hayes, Pub. Raven press, NY
2) Casarett and Doull's toxicology ed. John Doull, Curtio D Kleassen and Mary D Aunder, McMillan publisher Co, NY
3) Appraisal of the safety of chemicals in foods , drugs and cosmetics. Ed.The Editorial Committee of Association of Food and Drug Officials of the United States
4) Toxicology- Mechanisms and analytical methods, Vol I and II, ed Stewart CP and Stolman A, Pub Academic press
5) Veterinary toxicology by RJ Garner ed Beilliere, tindall and Cox London
6) The chemistry and microbiology of pollution (1975) IJ Higgins and RG Burns Acad Press , NY
7) Introduction to ecological biochemistry JB Harbone Acad Press, NY (1977)

BCH 374 Developmental Biology and Molecular Evolution

1) Theories of Evolution.-the time scale and some evolutionary principles. Chemical evolution and origin of life. Prototypes of metabolic pathways.
2) Genesis of oxygen generating photosynthesis and aerobic respiration. Methanogens – evolution of prokaryotes.
3) Evolution of protists.
4) Origin of eukaryotes

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5) Theories regarding origin of mitochondria and chloroplast, the five kingdom classification of living organisms, outline of eukaryote evolution- evolution of primates.
6) Construction of phylogenetic trees- molecular data set based on sequences.
7) Evolution of proteins and nucleic acid – elastic analysis.
8) Evolution of introns
9) Evolutionary view of exon domain relationships.
10)Developmental Biology—Cell differentiation, hierarchy of genes, measurement of time during development, nature of differentiation, DNA rearrangements& amplification, genetic control of morphogenesis, plant molecular genetics.

Reference Books

1) Evolution and Diversity of life, E. Mayer Belknap Press Pub, 1976
2) Population species and evolution (1973), E Mayer Press Pub.
3) Biochemistry , Lehninger (1975) Worth pub
4) Origin of Eukaryotic cells, Margulis L.(1977)

BCH 375 Nutrition and Clinical Nutrition

Nutrition:

1. Basic Concepts: Composition of Human body. Nutritional value of foods and effect of processing. Energy content and its measurement in foods. Thermogenic effect of foods.
2. Role of food proteins: Requirements and allowances. Proteins as building material, amino acid inter relationships. Protein quality and methods of determination. Factors affecting protein metabolism, Nitrogen balance studies and factors affecting it. Protein and amino acid requirement at different stages of development.
3. Carbohydrates and Energy metabolism: Dietary requirements and source of

carbohydrates, Classification – Available and Unavailable. Physico-chemical properties and the physiological role. Energy requirement and measurement of energy requirement: Direct and Indirect calorimetry. Factors affecting requirements; BMR, SDA and activity. BMR and relation of temperature regulation to basal metabolism.
4. Lipids: Nutritional classification of dietary lipids, sources and their physiological functions.
5. Minerals: Nutritional significance. Dietary Macro elements, Calcium, Phosphorus, Magnesium. Trace Elements, Iron, Iodine, Zinc, Copper etc.
6. Food utilization: Ingestion, digestion, absorption transport, storage and disposal of food nutrients (proteins, carbohydrates, fats, vitamins and minerals).
7. Primary Nutritional Diseases: Protein energy malnutrition, starvation, obesity, vitamin deficiency disorders and biochemical basis of causation and diagnosis of nutritional anaemias.
8. Conditional Nutritional Disorders: Disorders of Gastrointestinal tract, Liver, Biliary tract and Pancreas and Heart, Diabetes.
9. Food toxins and Allergy:

Clinical Nutrition

1) Diet and nutrition in India: Assessment of nutritional status
2) Factors affecting digestion and absorption of food
3) Effects of irradiation , cooking, refining, sprouting and fermentation on nutritional quality of food

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4) Food toxins, adverse effects of alcohol, tobacco, tea
5) Interrelationship between dietary lipids and cholesterol metabolism
6) Malnutrition and infection
7) Malnutrition and mental development
8) Infant and geriatric nutrition
9) Nutritional basis of behavior, neutral tranquilizers
10) Amino acid therapy
11) Acidic and alkaline foods
12) Dietary fiber- chemical composition and importance
13) Physiological effects and metabolic adaptation during exercise
14) Nutritional management of inborn errors of metabolism

Reference books:

1. Essentials of food and nutrition M Swaminathan Vol. II, Applied aspects (1974) , Ganesh Pub, Madras
2. Human biochemistry – James Orten and Otto Neuhaus, 10th ed , CV Mosby co London
3. Human nutrition and dietetics-Davidson and Passmore
4. Amino acids in therapy – Leon Chaitwo, Thorsons publishers Inc. NY
5. Physiological chemistry- Hawk

SEMESTER IV

BCH 470 Biochemical Endocrinology and Tissue culture

Biochemical Endocrinology

1) General characteristics of hormones: chemistry , structure, synthesis, secretion, transport, metabolism & mechanism of action of hormones of the thyroid, hypothalamus, pituitary, pancreas, adrenals, glands, prostaglandins and gastro intestinal hormones, calcium signaling, zinc fingers
2) Secondary messengers and their mode of action
3) Cell membranes and intracellular receptors for hormones
4) Hormonal inter relationship
5) Biosynthesis of steroid hormones, cholera toxin, adenylate cyclase and TP, hormone overproduction and target cell insensitivity
6) EGF, NGF, PDGF, Enkephalin

Reference books:

1) Vertebrate endocrinology- Noris DO (1985) 2nd ed
2) Endocrine physiology- Martin, CR (1985(O xford Univ press (NY)
3) Physiological chemistry –Harper 17ed Lange medical
4) Biochemistry- Zubay (1983) Addison, Wesley publ. Co.
5) Text book of biochemistry –Williams, 6thed Saundes Co (1981)
6) Biochemical endocrinology E Frieden (1983)

Tissue culture

Plant tissue culture

Media requirements, sterilization and role of growth regulators, Requirements of a plant tissue culture laboratory, Micropropogation, Somatic cell hybridization, Haploid

(anther) culture, Embryo culture, Protoplast fusion, Somatic embryogenesis Somaclonal variations, Cybrides and Allopheny, Cell suspension and callus culture, Agrobacterium mediated hairy root culture, Conditioning of tissue culture plants (weaning and hardening), Active principles in medicinal plants and phytochemistry of the metabolites of medicinal importance.

Animal tissue culture

Media requirements, preparation of medium and sterilization techniques, Advantages and disadvantages of natural and synthetic media, Culture methods – hanging drop, suspension and monolayer culture, Behaviour and characteristics of cells in culture, Primary and established cell lines, characteristics of transformed cells. Methods of cell preservation, Organ culture – clot grid, chorioallantonic and ocular culture, Animal cell culture techniques: Cell strains and cell lines, primary cultures and secondary cultures, media for tissue culture, cloning, heterocaryons, variant cells, contact inhibitions, cell and tissue banking.

Reference Books:

1. Neurochemistry by Ferdinand Hucho, VCH Publication, 1986
2. Molecular cell Biology by Lodish, Baltimore, et al W.H. Freeman & Co.1996
3. Tissue Culture by John Paul
4. Plant cell tissue and Organ culture by Gamborg Phillips
5. Culture of Animal Cells by Ian Freshney
6. Molecular Biotechnology by S. B. Primrose

BCH 471 Fermentation and Enzyme Technology and Food Technology

Fermentation and Enzyme Technology

1. Characteristics of industrial microorganisms
2. Strain improvement , use of auxotrophic mutants
3. Methods and parameters of cultivation of microorganisms , media for industrial fermentation
4. Fermenters, design of fermenters, fermentation process, and maintenance of aseptic conditions, aeration and agitation.
5. Downstream processing, recovery and purification of fermentation products, effluent treatment
6. Applications of fermentation technology
7. Enzymes as industrial catalysts
8. Rationale for immobilizing enzymes
9. Methods for enzyme immobilization, supports and their selection
10. Properties of immobilized enzymes, whole cell immobilization rationale, methods and applications, industrial stabilization of enzymes
11. Industrial applications of immobilized enzymes

Reference Books

1. Principles of Fermentation technology, PF Stanbury, A Whitaker, SJ Hall (1997)
2. Molecular biology and biotechnology- edited by JM Walker and FB Gingold, Royal society of chemistry (1988)

3. Immobilized enzymes- An introduction and application in biotechnology- Michael Trevan, John Wiley sons (1980)
4. Fundamentals of enzymology-NC Price and L Stevens.
5. Methods in Enzymology Ed by K.Mosbach Vol 44 (1976),Vol 135,135a (1987)
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Food Technology
1) Foods of animal and plant origin
2) Monitoring food quality
3) Primary feedstock
4) Proteins from unconventional sources- OCP, SCP etc
5) Starch production, manufacture of natural and synthetic sweeteners and syrups
6) Enzymes in food analysis , toxins, alcohol, amino acids, glucose
7) Enzymes in food processing, meat tenderization and fruit juice technology
8) Biochemistry of food spoilage, principles of food preservations
9) Food additives, starches, sugars, syrups and sweeteners, flavoring agents, colors
10)Genetically modified foods
Reference books
1) Enzymes and food processing- GG Birch, N Blackbrough (1981)
2) Nutrition and food processing- MG Miller , G Tobin, AVI publishing Co, Creem Holm (1980)
3) Introduction to food sciences and technology –GF Stewart and MA Amerine (1973) Academic Press
BCH 472 Genetic Engineering
1) Genetic engineering concepts
2) Enzymes in genetic engineering
3) Plasmids, bacteriophages, shuttle vectors,
4) Cloning in yeast, bacillus and streptomyces
5) Animal, virus and derived vectors- Phages , cosmid, M13, 2μcircles
6) Ti plasmids and plant genetic engineering
7) Genomic and C-DNA library construction
8) Selection of recombinant DNA clones, Southern and Northern blotting
9) Hybridization and immunological techniques
10) Characterization of recombinant gene-S1 mapping, sequencing
11) Restriction mapping, chromosome walking
12) In vitro mutagenesis
13) RFLP, PCR, DDRT PCR
14) Transgenic plant and animals
15)Application of genetic engineering in medicine, agriculture and industry.
16) Protein Engineering
17) Evolution
18)Developmental Biology
19)DGGE
20)Metagenomics
21)Microarray
Reference Books
1. Recombinant DNA- Short courses, JD Watson, John Tooze, David T. Kurtz, Scientific American books, WH Freeman &Co.
2. Principles of gene manipulation, SB Primrose (6^{th} ed).
3. Gene cloning- An introduction, T.A Brown, 2^{nd} &3^{rd} ed, Chapman &Hall.
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BCH 474 Genomics and Biotechnology
Genomics
DNA structure , replication, recombination, repair, RNA structure, different types of

transcription, post transcriptional modification, protein synthesis, activation of amino acids and RNA adapter role, ribosomes, initiation, elongation, termination, regulation of gene expression, viruses-replication, life cycle

Recombinant DNA technology, basic cloning steps, restriction endonucleases, vectors, ligation, transformation, identification of recombinants, hybridization, immunological tech, sequencing of DNA, site directed mutagenesis, cloning in bacteria, yeast plants, mammalian cell lines.

Biotechnology

1. Application of recombinant DNA technology in production of therapeutic proteins
2. Application of recombinant DNA technology in drug development
3. Application of recombinant DNA technology in forensic science
4. Application of DNA technology in production of recombinant diagnosis, enzyme engineering
5. Application of recombinant DNA technology in monoclonal antibodies
6. Immobilized biocatalysts and biosensors

Reference Books

1. Molecular biology and Biotechnology (3rd ed) JM Walker, EB Gingold, Panima publishing Corp., New Delhi/Bangalore
2. Introduction to the principle of drug design and action .(3rd ed) edited by H.John Smith, Horwood academic press

Practical for M.Sc. Part II Biochemistry

BCH-367 Molecular Biology and Clinical Biochemistry (5 Credits)

Molecular Biology

1. Isolation of DNA from E. coli/ liver/ plant/ plasmid
2. Determination of base composition (spectrophotometry)
3. Agarose gel electrophoresis of DNA
4. Restriction digests of DNA.
5. Isolation of plasmid
6. Transduction
7. Transformation
8. Expression analysis
9. Ligation
10. PCR
11. Plasmid mapping
12. Mutation
13. Induction of lac operon

Clinical Biochemistry

1. Estimation of Lipoproteins.
2. Glucose tolerance test

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3. Estimation of bilirubin
4. Estimation of blood urea
5. Blood sugar determination by Folin-Wu method
6. Estimation of creatine phosphokinase
7. Normal and abnormal constituents of urine
8. Determination of blood cholesterol
9. Determination of glucose by glucose oxidase method
10. Estimation of glycosylated hemoglobin
11. Estimation of LDH and its isozymes
12. Estimation of alkaline phosphatase from serum
13. Estimation of total protein and albumin from serum
14. Determination of SGPT and SGOT
15. Estimation of serum amylase

BCH- 368 Special experiments (3 Credits)

Special experiments

1. Affinity chromatography
2. Immobilization of enzymes
3. Sub cellular fractionation
4. Biosensors
5. Spectroflourimetry
6. HPLC
7. Immunochemical techniques
8. Immuno-electrophoresis
9. Ouchterlony double diffusion
10. Complement fixation test.
11. ELISA
12. Production of Monoclonal antibodies

Reference Books:

1. Practical Biochemistry- David Plummer
2. Practical Biochemistry – J. Jayaraman
3. Biochemical methods – Sadasivam and Manickam
4. Biochemistry –Practical Approach – Kieth Wilson and J. Walker
5. Introductory Practical Biochemistry- Randhir Singh and Sawhney

BCH 467 PROJECT 7 Credits

Industrial Study Tour

Summer Training

M. Sc. – II
Inorganic Chemistry
Syllabus

Semester – III

Papers No. of Lectures

CH-326 Organometallic compounds of Transition metals [60]
& Homogeneous catalysis

CH-330 Coordination Chemistry, Magnetism & Reaction Mechanism [60]

CH-331 Structural Methods in Inorganic Chemistry [60]

CH-332 Bioinorganic Chemistry: Inorganic Elements in the [60]
Chemistry of Life

Semester – IV

CH-430 Inorganic Solids & heterogeneous catalysis [60]

CH-431 Materials Science [60]

CH-445 Inorganic Applications in Industry, Biotechnology & [60]
Environmental Chemistry

SEMESTER - III

CH-326
Organometallic compounds of Transition metals
& Homogeneous catalysis

A. Synthesis and properties of organometallic compounds with i)carbonyl ii) hydrocarbyl iii) Phosphines iv) nitrosyl ligands [**18 L**]

B. Fluxionality of organometallic compounds [**4 L**]

C. Organometallic compounds as electrophiles, nucleophiles, activating agents, protecting agebts, redox agents [**8 L**]

D. Organometallic compounds, Environment, Agriculture & Medicine [**6 L**]

E. Homogeneous Catalysis:

I: General introduction to Homogeneous catalysis, explanation of Tollman's catalytic cycle [**4 L**]

II: Following processes should be taught with examples from each process.
i) Oxo process ii) Monsanto Process iii) Wacker Process iv) Epoxidation v) Use of Reppe's catalysis vi) Heck reactions vii) Suzuki coupling [**20 L**]

Reference Books:

1. Organometallic chemistry by R. C. Mehrotra and A. Singh, 1992, Wiley Eastern Ltd.
2. Inorganic chemistry by Butler, Harrod, 1989, Benjamin / Cummins Pub. Co.
3. Principles of organometallic chemistry 2nd Edn. P. Powell, 1988, Chapman and Hall.
4. Organometallic compounds –Morries sijlirn. IVY Publication house

CH-330
Coordination Chemistry, magnetism &
Inorganic Reaction Mechanism

Coordination Chemistry, magnetism

A. Recapitulation of CFT concepts [**4 L**]

B. Theories of magnetism, Exchange model [**6 L**]

C. Magnetism of monomeric & polymeric coordination compounds [**10 L**]

D. Study of mixed valence compounds, their magnetic behaviour [**10 L**]

Inorganic Reaction Mechanism

A. Types of Mechanism [**2 L**]
B. Substitution in square planar & octahedral complexes [**4 L**]
C. Electron transfer reactions of coordination compounds [**4 L**]
D. Inner & outer sphere reactions [**5 L**]
E. Photochemical reactions [**5 L**]
F. Oxidative addition, reductive elimination, insertion reactions [**5 L**]
G. Isomerisation [**5 L**]

Reference books:

Coordination Chemistry & Magnetism

1. Inorganic chemistry, Principle of Structure and Reactivity, 4th Edn.J. E. Huhay, E. A. Keiter, R. L. Keiter(1993), Addison Wesley Publishing Co.
2. Elements of Magnetochemistry, 2nd Edn., R. L. Datta& A. Syamal (1993) Affiliation, East-Wiley Press (p) ltd.
3. Magnetism and Transition Metal Complexes, F. E. Mabbs and D. J. Machin (1973) Chapman and Hall, London.
4. Coordiantion Chemistry, Bannerjee(1993), Tata McGraw Hill Publishing Co. New Delhi.
5. Physical Methods for Chemists 2nd Edn., R. S. Drago(1992).

Inorganic Reaction Mechanisms

1. Inorganic Chemistry by Shriver and Atkins. 3rd Edn(1999) Oxford University Press.
2. Mechanism of Inorganic Reactions, by Basalo & pearson(1977), Wiley Eastern Ltd.
3. Inorganic Reaction Mechanism by M. L. Tobe (1972), Thomas Nelson & Sons.

CH-331

Structural Methods in Inorganic Chemistry

A. Resonance techniques such as NMR. ESR, Mossbauer, NQR & cyclic voltammetry [**35 L**]
B. Non resonance techniques such as XRD, Thermo-gravimetric analysis (TG, DTA, DSC). [**15 L**]
C. Introduction, Principle and applications of X-ray Photoelectron Spectroscopy, Auger Photoelectron Spectroscopy, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), [**10 L**]

1. Instrumental Methods of Chemical Analysis.(1979) Chatwal-Anand-Himalaya Publishing House.
2. Laboratory Techniques in Electroanalytical Chemistry edited by P. T. Kissinger and W. R. Heinman(1984)M Dekker vInc.(USA).
3. Electrochemical Methods, Fundamentals and Applications by A. J. Bard and L. R. Faulkner (1980), John Wiley (NY).
4. i) Dennis H. Evans, Journal of Chemistry, Education 60, 290(1983).
ii) P. T. Kissinger, W. R. Hienman, Journal of Chemical Education, 60, 702(1983).
iii) J. J. Van Benschoten, J. of Chemical Education, 60, 772, (1983).
5. An introduction to Thermogravimetry by C. J. Keatlih an D. Dollimore(1975), Heydon and Sons Ltd.
6. Thermal Method of Analysis by W. W. Wendlandt, 3rd Edn. 1986 john Wiley(NY).
7. Thermal Method sof Analysis by P.J. Haines 1995, Blackie Academic and Proffessionals.
8. Introduction to X-ray powder Diffractometry by R. Jenkins and R. Snyder 1996, Wiley(NY).

CH-332

Bioinorganic Chemistry:

Inorganic Elements in the Chemistry of Life

A. Structure, functions & biochemistry of enzymes containing

following metal ions:
1. Zinc [**6 L**]
2. Copper [**6 L**]
3. Nickel [**6 L**]
4. Manganese: photosynthesis, catalase, peroxidases [**6 L**]
5. Reactions of Cobalamin [**6 L**]
At least one model compound of each of the enzyme should be discussed in the class

B. Medicinal Inorganic Chemistry
1. Chemical Nucleases [**12 L**]
2. Radiopharmaceuticals [**10 L**]
3. MRI contrast reagents [**8 L**]

Metalloprotiens & Bioinorganic Medicines
1. Biological Chemistry of Elements. J. J. R. Frausto da Silva, R. J. P. Williams, Chapters 2,12,14, 15, 16, 17.
2. Principles of Bioinorganic chemistry by S. J. Lippard and J. M. Berg, (I1994) University Science Books(USA)
3. Bioinorganic chemistry: inorganic elements in the chemistry of life, An Introduction And Guide by Wolfgang Kaim, Brigille Schwederski91994) John Wiley and Sons.
4. Bioinorganic chemistry, Bestini, Gray, Lippard, Vlentine, 1st South asian Edn.(1980) Viva books pvt.ltd.
5. Comprehensive coordination chemistry Vol.VI
6. Bio-organic chemistry: a Chemical approach to enzyme action 3rd edition.

Semester – IV

CH-430

Inorganic Polymers & Heterogeneous catalysis

A. Inorganic Polymers [**18 L**]
1. Polycationic & polyanionic compounds
2. Peroxides, peroxyacids and heteropolyacids
3. Metal clusters

B. Introduction to heterogeneous catalysis: [**12 L**]
1. Basic principles
2. Classification
3. Quantitative aspects of adsorption & catalysis
4. Types of reactors

C. Zeolite and Supported Metal Catalysts [**15 L**]
D. Nanomaterials as Catalysts: Environment, Organic, Semiconducting [**10 L**]
E. MCM-41, Clays as catalyst [**5 L**]

Heterogeneous Catalysts and Structural Methods.
1. Encyclopedia of analytical science, Academic Press Vol.1 to 9 1995, Editor Alan Townshend
2. Studies in surface science and catalysts, Vol. 85, 1994, Elsviere science Publications, B. V. pg: 9 to 42. Vol, 137 (2000) pg: 37 to 65.
3. Verified Synthesis of Zeolite Material, Elsevier Science Pub. (2001) pg: 19 to 100.
4. Comprehensive Coordination Chemistry Vol. VI

CH-431

Material Science

A. Diffusion in solid and its mechanism [3 L]
B. Solid state reactions and crystal growth [5 L]
C. Imperfection and related phenomenon in solids [6 L]
D. Nanomaterials:
1. Introduction, types & properties [4 L]
2. Following nanomaterials should be covered with reference to basic

aspects, properties & applications
a. Electronic & optical materials [10 L]
b. Magnetic materials [8 L]
c. Superconducting materials [6 L]
d. Ceramic materials [6 L]
e. Biomaterials [6 L]
f. Nanocomposites [6 L]
1. Introduction to Solids, I.V. Azerroff
2. Principles of solid state, H.V. Keer
3. Solid state chemistry, N.B. Hannay
4. Elements of material science, Van Vleck
5. Electronic structure & chemistry of solids, P.A. Cox
6. Insight into speciality Inorganic Chemistry, David Thompson

CH-445

Applications of Inorganic Chemistry in Industry, Biotechnology & Environmental Chemistry

(Any two sections from CH-445)

Section A: Applications of Inorganic Materials

1. Electrochemical Applications [9 L]
2. Dyes & pigments: Inorganic pigments, classification, properties, Azo dyes, natural dyes and their interactions with metals [10 L]
3. Composite materials: Synthesis, properties & applications [9 L]
4. Miscellaneous applications [2 L]

Two research papers related to electrochemical applications & natural dye with metal should be discussed in the class

Section B: Environmental Chemistry: Waste Water treatment & analysis

1. Introduction to waste water analysis; Specification of treated wastewater for disposal into surface water Screening chamber, Grit chamber, Oil & grease removal [**6 L**]
2. Wastewater engineering for biological treatment: Principle, role of micro organisms, ecosystem, designing of biological unit [**12 L**]
a. Stabilisation pond
b. Aerated lagoon
c. Activated sludge process
d. Trickling filters
e. Anaerobic treatment
3. Biotechnology & Wastewater Management: Applications of biotechnology for the treatment of a. High strength waste b. primary & secondary sludge c. phenol & cyanide removal [**4 L**]
4. Energy sources for future: Solar energy, energy from biomass, wind Towers, geothermal etc [**4 L**]
5. Inorganic metals in environment: Bioaccumulation of toxic metals Lead, mercury, calcium, arsenic [**4 L**]

Section C: Applications of Inorganic Chemistry in Biotechnology

1. Biotechnology: Introduction [**3 L**]
2. Living things & Industrial Processes [**3 L**]
3. Biotechnology & fuels [**3 L**]
4. Biotechnology & food [**7 L**]
5. Biotechnology & water [**7 L**]
6. Biotechnology & health and diseases [**7 L**]

1. Elements of Biotechnology by p. K. Gupta(2003), Rastogi Publications
2. Environmental chemistry by A. K. Bagio.
3. Principle of environmental chemistry by James Girard. Bartlett publishers

4. Wastewater engineering, Calf & Eddy
5. Wastewater treatment for pollution control, Arceivala
6. Manual on sewage & sewage treatment, Ministry of Works, Delhi
7. Principles of water quality control, T.H.Y. Tebbut

Inorganic Chemistry Practical

CH-387

Experiments & computer applications in Inorganic Analysis

A: Analysis of the following samples (any ten)

a) Ore b) Alloy c) Cement d) Manganese from tea leaves
e) Vitamin C from Lemon juice (Biological fluid) f) fertilizer (PO_4^{3-})
g) Analysis of Na, K & Ca using Flame photometry h) Soil analysis
i) Ion exchange j) Copper from fungicide

B: Statistical Analysis of data obtained from the estimation of following compounds using computational methods

a) Iron b) Copper c) Nickel d) Cobalt e) Chromium
f) Zinc g) Manganese

CH-388

Practical Course – II

A: Inorganic Instrumental Analysis and computer applications

1. To determine magnetic susceptibility of coordination compounds (two)
2. TGA analysis of coordination compounds (two)
3. Kinetics of aquation of a) Cobalt complex b) iron complex
4. Photochemical reaction – Metal to Ligand charge transfer
5. Table work on analysis coordination compounds using **ANY FOUR Techniques** a) IR b) ESR c) Cyclic voltammetry d) NMR e) XRD
6. Kinetics of dye degradation using CdS nanoparticles
7. Catalytic transfer hydrogenation of nitrobenzene to aniline using a catalyst
8. To study the Metal-DNA interaction spectrophotometrically

The structural analytical data should be analysed using computational methods.

B: Preparation of inorganic compounds (any ten)

a) NiO b) Nickel ferrite c) Zinc ferrite d) trans-$[Co(en)_2Cl_2]Cl$
e) $K_3[Cr(ox)_3]$ f) $(NH_4)_3[Cr(ox)_3]$ g) $[Cu(acac)_2]$ h) [Mn(salen)]
i) $[Mn(acac)_3]$ j) $[Cu(thiourea)_3]_2SO_4$ k) Copper phthalocyanin
l) copper-1,10-phenanthroline

CH-488

Projects/Extended Practicals in Inorganic Chemistry

A: Preparation and purity of following complexes of

1. DMG
2. 8-hydroxy quinoline
3. Salicyaldoxime
4. thiourea

with **Copper, Nickel, Iron, Chromium & Manganese** (**any three metals**)

B: Structural determination of above complexes using following techniques
i) UV-Visible spectroscopy ii) Magnetic susceptibility
iii) Thermogravimetric analysis iv) IR v) Solution conductivity

C. Introduction to literature survey

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University of Pune : Other Centres

M.Sc. Part II Physical Chemistry

Structure Of The Syllabus

Semester III

CH-310 Quantum Chemistry and Solid state chemistry

CH-311 Nuclear and Radiation Chemistry

CH-312 Advanced Instrumental Methods of analysis

CH-313 Physical chemistry Practical –I

Optional Courses (any one of the following)

CH-314 Polymer Chemistry

CH-315 Special topics in Physical Chemistry

Semester IV

CH-410 Molecular Structure and Spectroscopy

CH-411 Surface and Electrochemistry

CH-412 Physical Chemistry Practical II

CH-413 Physical Chemistry Practical III/Project

Optional Courses (any one of the following)

CH-414 Biophysical Chemistry and Related Techniques

CH-415 Special topics in Nuclear Radiation Chemistry

CH-310 Quantum Chemistry and Solid State Chemistry

Quantum Chemistry

1. Postulates of quantum mechanics, properties of quantum mechanical operators, Eigen functions and Eigen values, Hermitian, linear, ladder, and angular momentum operators. term symbols and selection rules, spin –orbit coupling, regular and inverted multiples (9L)

2. The variation method, theorem and applications, non-degenerate perturbation method (9L)

3. Application of LCAO-MO theory on the basis of Huckel approximation to conjugated aliphatic molecules and monocyclic conjugated polyenes. Huckel (4n+2) rule, calculation of resonance stabilization energy from Schaad and Hess model, antiaromatic molecules. (12L)

Text Books

1. Quantum chemistry (4^{th} edition), Ira N.Levine, Prentice Hall, Englewood Cliffs, NJ

2. Quantum Chemistry- A.K. Chandra

3.D. A. McQuarrie, Quantum Chemistry, Viva Books, New Delhi (2003)

Solid State Chemistry

1. Properties of metals and semiconductors: band theory, types of solids, intrinsic and extrinsic semiconductors, p-n junctions, optical properties, photoconductivity of crystals (7L)

2. Imperfections and related phenomenon: Defects in solids: point defects line defects, diffusion in solids- mechanism, elastic and plastic deformations (5L)

3. Crystal growth techniques: General principles, growth from solution, growth from melts , growth from vapour (4L)

4. Imperfections and physical properties crystals: Electrical properties, Optical properties : Colour centers in ionic crystals: types, creation,

Magnetic properties , Thermal properties and Mechanical properties. (8L)
5. Solid state reactions: reactions of single solids and their kinetic characteristics, gas -solid, solid -solid, addition and double decomposition reactions, photographic process (6L)

Text Books:

1) Introduction of Solids L.V Azaroff , Tata McGraw Hill
2) Principles of the solid state H. V. Keer, Wiley Eastern (1993)
3) Selected topics in solid state physics Vol. 12, The growth of crystals from liquids –J. C. Brice, North Holland/American Elsevier (1973)
7. Defects and diffusion in solids. S. Mrowec Elseivier publ.(1960)
8. Treatise on solid state chemistry, ED-N.B. Hannay, Plenum press Vol –2 (1975)

CH-311 Nuclear and Radiation Chemistry

1. Nuclear fission -: The discovery, conformation of nuclear fission, types of fission reaction, mass distribution of fission product, emission of neutron in fission, fissile and fissionable nuclides, theory of nuclear fission, critical energy for fission, products of nuclear fission (6L)
2. Nuclear reactors -: General aspects of reactor design, thermal, fast and intermediate reactors, reactor fuel materials, reactor moderators and reflects, coolants, control materials, shield, regeneration and breeding of fissile matter, types of research reactors. (6L)
3. Nuclear structure-: The liquid drop model, calculation of nuclear binding energies, properties of isobars, missing elements, the nuclear shell model, magic numbers, filling of nucleon shells, the collective and unified models.
(7L)
4. Ion beam analysis techniques : Particle induced X-ray emissions- projectile accelerator and target preparation, ionization and X-ray emission detection,analysis and applications. Rutherford back scattering – scattering reaction,surface analysis,depth profiling, chanelling effects and applications
(5L)
4. Nuclear reactions: Bethe's notation, types of nuclear reactions, conservation in nuclear reactions, compound nucleus theory, experimental evidence, specific nuclear reactions, photonuclear and thermonuclear reactions. (6)
6. Accelerators: Basic components,Cockroft-Walton acceleratorVan de Graaff accelerator, Linear accelerators,cyclotrons, synchrotrons,
(4L)
5. Radiation detectors: Scintillators and their properties inorganic and organic, solid state semiconductor detectors-theory, surface barrier, Li drifted and intrinsic detectors (5)
6. Radiolysis of aqueous solutions : Radiolysis of water,ferric sulphate,ceric sulphate, cupric sulphate solutions (5)
7. Radiation hazards and safety ; Natural and manmade sources of radiations, internal and external radiation hazards, safe handling methods, personal dosimetry, reactor safety, the effects of Three miles and Chernobyl accidents, radiation protecting materials. (6)
8. Biological effects of radiations : The interaction of radiations with biological cells,various stages, somatic and genetic effects, maximum permissible dose-ICRP recommendations (5)
9. Hot atom chemistry : Szilard Chalmers process, chemistry of recoil atoms, recoil techniques, models for retention, annealing reactions, annealing mechanisms (5)

Text Books :

1. Essentials of Nuclear Chemistry, H. J Arnikar, Wiley Eastern Limited, 4th Edition.(1995)
2. Nuclear and Radiochemistry, G. Friedlander, J. W. Kennedy and J. M. Miller,

John Wiley (1981)
3. Introduction to Radiation Chemistry, J. W. T. Spinks and R. J. Woods, John Wiley (1990)
4. Introduction to Nuclear Physics and Chemistry, B.G. Harvey, Prentice hall (1963).
5. Sourcebook on Atomic Energy-S. Glasstone, Van Nostrand Company (1967)
6. Radiochemistry and Nuclear methods of analysis-W.D.Ehman and D.E. Vance, John Wiley (1991)

CH-312 Advanced instrumental methods of analysis

1. X-ray methods

Generation and properties of X-rays, X-ray absorption, Concept of absorptive edge, applications, X-ray absorptive apparatus, radiography and radiotherapy, applications X ray fluorescence, fundamental principles, instrumentation, wavelength dispersive and energy dispersive, qualitative and quantitative analysis, X-ray emission, fundamental principles, electron microprobe, further advanced techniques,Introduction to STEM, SEM
(7L)

2. Luminescence, chemiluminescence, electrochemiluminescence, apparatus, fluorescence, phosphorescence, theory, factors affecting intensity, apparatus, analytical applications.
(8L)

3. Mass spectrometry : Theory, instrumentation-basic components, ionization sources, analyzers, resolution, chemical analysis, advanced techniques—GC/MS, MS/MS introduction
(6L)

4. Neutron Activation Analysis : Principle, target, matrix, cross-section, fluxes, saturation activity, excitation function, Different steps involved in NAA, radiochemical and instrumental NAA, prompt radiation and pulse neutron activation analysis, applications (10L)

5. Inductively coupled plasma atomic emission spectroscopy: principle, instrumentation,analysis and applications (6L)

6. Thermal methods of analysis: TGA, DTA, DSC and thermometric titrations – principle, instrumentation, factors affecting TGA curve, applications
(6L)

7. Electron spectroscopy for chemical analysis : Theory, spectral splitting and chemical shift. Apparatus used for ESCA, applications. (5)

8. Coulometry: Current-voltage relationship, coulometric methods, controlled potential coulometry (5)

9. Voltammetry: Excitation signals,instrumentation, hydrodynamic voltametry, cyclic voltametry, pulse voltametry, applications (7)

Text Books :

1) Introduction to instrumental analysis-R. D. Braun, McGraw Hill (1987).
2) Principles of instrumental analysis – Skoog, Holler, Nieman, 5th edition.
3) Principles of activation analysis - P. Kruger , John Wiley (1971)
4) Nuclear analytical chemistry- J. Tolgyessy and S. Verga Vol. 2 , University park press (1972)

CH-313 - Physical Chemistry Practicals I (Compulsory Course)

1) Thermodynamic data of electrochemical cell by e.m.f.measurements.
2) Simultaneous determination of two ions by polarography.
3) Determination of the equilibrium constant of triiodide ion formation
4) Magnetic susceptibility measurement by Gouy technique.

5) Determination of dipole moment of liquid at various temperatures.
6) Kinetics of iodination of aniline: pH effect and base catalysis.
7) Dissociation constant of an acid- base indicator by spectrophotometry.
8) Actinometry – photolysis of uranyl oxalate
9) Absorption coefficient and half thickness of lead for gamma radiation.
10) Radiation dose measurement by Fricke dosimeter/ceric sulphate dosimeter.
11). Flame Photometric determination of Na, K, Li and Ca (Working curve method)
12) A photometric titration of a mixture of Bi and Cu with EDTA (-745nm)
13)Determination of lead in petrol by atomic absorption technique.
14) To investigate the reaction between potassium persulphate and potassium iodide by colorimetry.
15) To determine the chain linkage in poly (vinyl alcohol) from viscosity measurements.
16) Calibration of Gamma ray spectrometer and determination of energy of given radioisotope

CH-314 Polymer Chemistry

1. Basic concepts of polymer science, classification of polymers as biological - nonbiological, linear branched network, condensation, addition homo- and heterochain, thermoplastic - thermosetting, History of Macromolecular Science, molecular forces and chemical bonding in polymers. (5L)

2. Thermodynamics of polymer solutions - Entropy and heat of mixing of polymer solutions - ideal behaviour and deviations. Experimental results, flory - Krigbaum theory - Thermochemistry of chain polymerization. (5L)

3. Copolymerization - Kinetics of copolymerization, the copolymer equation, monomer reactivity ratios, instantaneous composition of polymer. (6L)

4. Morphology and rheology of polymers - configuration of polymer chains crystal structure, crystallization processes, viscous flow, rubber elasticity, viscoelasticity, the glassy state and glass transition, mechanical properties of crystalline polymers. (8L)

5. Polymer structure and physical properties - The crystalline melting point T_m- the glass transition temperature (T_g) - properties involving small and large deformations- polymer requirements and polymer utilization. (6L)

6. Analytical chemistry of polymers - physical and chemical analysis: IR, NMR and EPR spectroscopy, XRD analysis, thermal analysis - TGA, DTA, microscopy, physical testing. (8L)

7. Measurements of molecular weights - characterization of polymers, Molecular weight averages, fractionation and molecular weight distribution - methods for determination of average molecular weight (end group analysis) colligative property measurements, osmometry, diffusion light scattering, viscosity, ultracentrifugation. (8L)

8. Polymer processing - Plastic technology - molding, other processing techniques fibre technology - textile and fabric properties, spinning fibre after treatments, elastomer technology- natural rubber, vulcanization, reinforcement, carbon blocks. (5L)

9. Radiation induced polymerization - kinetics and mechanism of polymerization in the liquid and solid phases, effect of irradiation on polymers - degradation and cross-linking, block copolymerization. (5L)

10. Conducting polymers - Basics, synthesis, conduction mechanism, applications.

(4L)

Text Books :

1) Textbook of Polymer Science - F. W. Billmeyer Jr., John Wiley & Sons Inc. (1971)
2) Principles of Polymer Systems - F. Rodrigues, Tata McGraw Hill Publishing Company, New Delhi
3) Principles of Polymer Chemistry - P. J. Flory, Cornell University Press, Ithaca New York (1953)
4) Polymer Chemistry - An introduction, Seymour-Carraher, Marcel Dekker Inc, New York
5) Polymer Science - Gowarikar, Vishwanathan & Sreedhar, Wiley Eastern Ltd. New York (1988)
6) Handbook on Conducting Polymers - T. A. Skotheim, Ed., Marcel Dekker Inc, New York, 1&2 (1986)

CH-315 Special Topics in Physical Chemistry

1. Chemical sensors

Different types of sensors, semi conducting oxide sensors, electrochemical sensors, biosensors e.g. glucose, testing of sensors, Lab-on-a-chip. (8L)

Reference.

1. Principles of Chemical Sensors, Jiri Janata, Plenum Press, New York and London.
2. Chemical Sensors, T.E.Edmonds, Chapman and Hall, New York, (1988).
3. Ceramic Sensors: Technology and Applications, G.Nenev, (1996)

2. Ionic equilibria and pH calculations

Solution of an equilibrium problem, general approach to problem solving, mass balance, the proton condition, charge balance; solving simultaneous equations, Weak acid problem: exact solution, approximations on the equations, Weak acid problem: approximate solution, Graphical representations – the distribution diagram, the logarithmic concentration diagram. Construction of a logarithmic concentration diagram, calculations using a logarithmic diagram, pH of a weak base, pH of salts of a weak acid strong base and strong acid weak base, Polyprotic acids – stepwise dissociation , distribution diagram, logarithmic concentration diagram, pH calculations.
(12L)

Reference.

1. Ionic Equilibirium A Mathematical Approach, J.N.Butler, Addison-Wesley Publishing Co. Inc.

3. Nanoscience : Materials and Technology

Lowdimensional structures – quantum wires and dots, excitons, nanotube, porous silicon and other special nanomaterials. (4 L)

Properties of nanoparticles : Mechanical, thermal, optical, magnetic and electrical. (4 L)

Applications : LED, SET, GMR, display panels, sensors, medicine (4 L)

Ref. Books.

1. Quantum Dots - L.Jacak, P. Hawrylak. A. Waojsspringer (1977)
2. Optical properties of semiconductor nonocrystals – S. V. Gaponko Cambridge Press (1977)
3. Physics of low dimensional structures – J. H. Davies – Cambridge (1998)
4. Semiconductor quantum dots – L.Bajaj and S.W. Kotch
5. Low dimentional semiconductors – M. J. Kelly Carcdon (1995)
6. Physics and applications of semiconductor microstructures – M. Jaros Clarendon (1989)

4. Smart Materials

Definition of smart materials (SM), Design of intelligent materials, actively smart and passively smart materials and their characteristics. e.g. - smart ceramics, oxides, smart polymers and gels, shape memory alloys, electorheological fluids, ferrofluides, smart windows, smart sensors, smart electroceramics. Magnetostrictive materials, biomineralisation and biosensing. Integration to smart clothes, smart rooms. (8L)

References:

1. Smart materials : Review by 'Newman' in Journal of American ceramic society.(J.Am.Cerac.Soci) 74 (3) 463 – 80 (1991)
2. Intelligent materials – Craig A. Rogers,Scientific American,1995,p.122
3. Smart structures and materials by B.Culshaw (Artech House,Norwood,MA 1998)
4. Sensors,actuators and smart materials by S. Trolier- McKinstry and R.E.Newman
5. MRS Bulletin ,April 1993,P 27
6. Intelligent Gels Y.Osada and S.B. Ross – Murphy-Scientific American May 1993 p.82

5. Phase Studies : 10 L

Temperature – Composition diagrams, lever rule, phase rule, counting components, experimental procedures, liquid – liquid, liquid-solid diagrams, eutectics, technologically important eutectics, ultra-purity, controlled purity, role of added salt, supercritical liquids and applications.

Ref. :1. Thermodynamics, statististical thermodynamics and kinetics Thomas Engel, Philip Reid 1st Edn.
2. Physical chemistry- Ira Levin 1st Edn
3. Physical chemistry- P.W. atkins, 8th edn.

6. Catalysis

Introduction with definitions of various terms involved in catalysis. Acid-base catalysis in dilute aqueous solutions, general and specific acid-base catalysis. Organometallic catalysis, reactions of transition metal complexes. Catalysis by enzymes, Michachis-Menten kinetics, enzyme activities. (10L)

Reference

Catalytic Chemistry, Bruce C. Gates, John-Wiley & Sons. Inc.

CH-410 MOLECULAR STRUCTURE

1. Nuclear Magnetic Resonance Spectroscopy

Nuclear spin, nuclear resonance saturation. Shielding of magnetic nuclei, chemical shift and its measurements. Factors influencing chemical shift, deshielding, spin-spin interactions, factors influencing coupling constant "J" Classification (ABX,AMX,ABC. A2 B2) spin decoupling, basic ideas about Instrument, NMR studies of nuclei other than proton ^{13}C, ^{19}F and ^{31}P, FT NMR, advantages of FT NMR, use of NMR in medical diagnostics. (10L)

2. Electron Spin Resonance Spectroscopy

Basic principles, Zero field splitting and Kramers degeneracy,factors affecting the "g" value . Isotropic and anisotropic hyperfine coupling constants, spin Hamiltonian, spin densities and Mc Connell relationship, measurement techniques, applications. (10L)

3. Nuclear quadrupole resonance spectroscopy

Quadrupole nuclei, quadrupole moments, electric field gradient, coupling constant, splitting, and applications. **(**3L**)**

4. Photoacoustic Spectroscopy

Basic principles of photoacoustic spectroscopy (PAS) ,PAS gases and

condensed system, chemical and surface, applications. (3L)

5. X- Ray diffraction

Index reflections, Identifications of unit cell from systematic absences in diffraction pattern. Structure of simple lattices and X-Ray intensities Structure factor and its relation to intensity and electron density , phase problems in XRD (10L)

6. Electron Diffraction

Scattering intensity Vs Scattering angle, Wierl equation, measurement technique, elucidation of structure of simple gas phase molecules, low energy electron diffraction and structure of surfaces. (10L)

7. Neutron Diffraction analysis

Scattering of neutron by solids and liquids, Magnetic scattering, Measurement techniques, Elucidation of structure of magnetically ordered unit cell. (4L)

8. Magnetic susceptibility

Pacal constant, Diamagnetic susceptibility, paramagnetic susceptibility , Langevin Equation ,Van Vlecks formula, Ferro, Ferri and Antiferromagnetism, Measurement of Magnetic susceptibility by Faraday and Gouy Techniques.(10L)

References

1, Modern Spectroscopy J.M. Hollas, (John Wiley)
2. Spectroscopy (Atomic and Molecular) Gurdeep Chatwal,Sham Anand (Himalaya Publishing house)
3. Applied Electron spectroscopy for Chemical analysis Ed. H. Windawi & F.L. Ho (Wiley interscience)
4. Introduction to Magnetic resonance A. Carrington and A.D Maclachalan , Harper & Row
5. Spectroscopy B.K. Sharma
6. NMR, NQR, & Mossbauer spectroscopy in Inorganic chemistry R.V.Parish, Ellis Harr wood
7. Physical methods in Chemistry R.S Drago, Saunders college
8. Introduction to Molecular Spectroscopy G.M. Barro, Mc Graw Hill
9. Basic principles of spectroscopy R.Chang, Mc Graw Hill
10. A text book of Spectroscopy .O.D.Tyagi & m.Yadhav Anmol Publications
11. Introduction to Magento chemistry Alen Earnshaw, Acad Press (1968)
12. Magneto chemistry Sanyl and Dutta
13. Chemist's guide to NMR spectroscopy – Mc Comber (Wiley) 2000.

CH - 411 – Surface and Electrochemistry

Surface Chemistry

1. Adsorption at liquid surfaces, Gibbs equation and its verification, Gibbs Monolayers, insoluble films on liquid substrates, states of monomolecular Films, Wetting, flotation, detergency. (6 L)

Ref. 1,6

2. Adsorption forces, thermodynamics of physical adsorption, heat of adsorption and its determination, measurement of adsorption by different methods, chemisorption and its mechanism. (6 L)

Ref. 1,2,5,6

3. Multilayer adsorption – critical comparison of various multilayer models- BET, Potential and Polanyi models (no derivation). Measurement of surface area of solids by different methods. Harkins and Jura equation. (6 L)

Ref. 1, 6

4. Porous solids – Defination, pore size distribution, methods to determine pore size, hysteresis of adsorption, theories of hysteresis, Adsorption behaviors of porous

materials, (4 L)
Ref. 3,4,6
5. Catalysis - Introduction and basic concepts – Industrial heterogeneous catalysis. Definitions – catalyst, catalyst activity, catalyst selectivity, negative catalyst, heterohomogeneous catalysis, sites, turnover number, functionality, naming of catalyst and catalyst structures, catalyst deactivation. Zeolites – their structure and application as molecular sieves, catalyst and carriers of radioactive wastes (8 L)
Ref. 7,4,5

References :

1. Physical chemistry of surfaces – A. W. Adamson, Interscience publishers Inc New York, 1967.
2. Surface chemistry – Theory and applications, J. J. Bikerman, Academic press, New York 1972.
3. Adsorption, surface area and porosity – S. J. Gregg and K. S. W. Sing, Academic Press Ltd., London 1967.
4. Zeolities and clay minerals as Adsorbents and molecular sieves, R. M. Barrar, Academic Press London.
5. Physical adsorption of gases, D. M. Young and A. D. Crowell, Butterworths, London, 1962.
6. Adsorption, J. Oscik, John Wiley and Sons. New York.
7. Heterogeneous catalysis in practice, Charles N. Satterfield, Mc Graw- Hill Chemical Eng. Series.

Electrochemistry

1. Ionics - Ion-solvent interactions, ion –dipole theory of solvation, ion-ion interaction, Debye-Huckel limiting law, extended law, activity coefficients, electrochemical potential. Ion transport in solution. - Fick's laws of diffusion, Einstein relation between diffusion coefficient and ionic mobilities.
(10L)
Ref.1,2
2. Electrodics – Standard electrode potentials, different chemical and physical processes at the electrode surfaces, electrode-electrolyte interface, double layer and phase boundaries, Butler-Volmer equation, Tafel equation.
(10L)
Ref 1,2
3. Applications -
a. Fuel cells and batteries – primary and secondary power cells, fuel cells, Li ion battery, evaluation of performance of electrochemical systems, energy density, shelf life, and Faradic efficiency.
b. Corrosion and corrosion prevention- Thermodynamics and kinetics of corrosion, methods of prevention to corrosion.
c. Electrosynthesis – use of electrodes in synthesis of organic compounds
(10L)
References

1.Physical chemistry - Peter Atkins, Julio de Paula , 7th Edition Oxford University Press.
2. Modern Electrochemistry - Vol I & II J. O'M Bockris and AKN Reddy, Plenum Press,N.Y.
3. Fuel cells - Their Electrochemistry, J.O'M Bockris and S Srinivasan, McGraw Hill, NY (1969)
4. Fuel cell systems L.I. M Blomen and M.N. Mugerwa, Plenum Press NY

(1993)
5.Electrochemical techniques in corrosion science and engineering
R.G.Kelly, J.R.Scully D.W.Shoesmith and R.G. Buchheit Dekker NY 2003
6.Lectures on electrochemical corrosion M.Pourbaix, Plenum NY (1973)
d.

CH-412 Physical Chemistry Practical II (Compulsory)

1. Hydrolysis constant of aniline hydrochloride by distribution coefficient method.
2. Determination of the dimerization constant of an organic acid in benzene.
3. Differential potentiometric titration.
4. Amperometric titration with platinum microelectrode.
5. Determination of the stability constant of a complex by spectrophotometry.
6. Determination of the heat of ionization of phenol/weak acid.
7. Studies on a clock reaction: determination of the energy of activation
a. Reactions such as bromate-bromide reaction, iodate –iodide reaction,
b. Formaldehyde - bisulphite reaction etc.
8. Magnetic susceptibility measurements by the Faraday technique.
9. Analysis of fruit juice for vitamin C by HPLC technique.
10. Determination of half-life of two isotopes in a mixture.
11. Study of characteristics of GM counter.
12. Effect of salt on the distribution of acetic acid between water ethyl acetate.
13. To study the effect of addition of a salt on the solubility of an acid in water.
14. Determination of concentration of sulfuric acid, acetic acid and copper sulphate by conductometric titration with sodium hydroxide.
15. Determine the formula and stability constant of a metal ion complex (Lead Oxalate) by polarography.
16.Analysis of tertiary mixture by Gas chromatography.

CH- 413 - Project or Additional Practicals (Compulsory)

1. Solubility of a sparingly soluble salt by conductometry.
2. Coulometric estimation of arsenite by bromine.
3. Dead stop end point titration.
4. Activity coefficient of electrolyte by emf measurements.
5. Titration of polybasic acid with sodium hydroxide by pH- metry.
6. Formation constant of a complex by pH- metry
7. Kinetics of the reaction between 2,4-dinitrochlorobenzene and piperidine.
8. Dipole moment of a liquid at various temperatures.
9. Latent heat of fusion by solubility measurement at various temperatures.
10. Determination of solubility diagram for a three component liquid system.
11. Radiolysis of aqueous iodate solution and determination of G values.
12. Molecular weight of a polymer by end group estimation.
13. Determination of the formula of complexes such as silver –ammonia complex by titration, cuprammonium ion complex by distribution coefficient measurement, Determine the transport number of silver and nitrate ions in aqueous solution from the cell potential of the concentration cell with junction potential.
15.Recording of TGA curve of $CuSO_4$ and NaCl and hence to find the percentage composition of the mixture.

Reference.

1. Findlay's Practical Chemistry, S.P.Levitt (Editor), Longman Group Ltd.
2. Experimental Physical Chemistry, Farrington Daniels and others, McGraw-Hill Book Company.
3. Experiments in Physical Chemistry, J.M.Wilson and others, Pergamon Press
4. Practical Physical Chemistry, A.M.James and P.E.Pritchard, Longman Group Ltd.

5. Experimental Physical Chemistry, V.Dathavale, Parul Mathur, New Age International Publishers.
6. Experimental Physical Chemistry, Das and Behera, Tata McGraw-Hill.
7. Practical Physical Chemistry, D.V.Jahagirdar

CH-414 Biophysical Techniques

1. Biological cell, structure and functions of proteins, enzymes,DNA and RNA in living system.(6)
2. 2. Statistical mechanics of biopolymers, chain configuration of macromolecules, statistical distribution end to end dimentions, calculation of average dimensions for various chain structures.(8)
3. Forces involved in biopolymer interactions. Electrostatic charges and molecular expansion, hydrophobic forces,dispersion force interactions. Multiple equilibria and various types of binding processes in biological systems.Hydrogen ion titration curves.
4. Thermodynamics of biopolymer solutions, osmotic pressure, membrane equilibrium, muscular contraction and energy generation in mechanochemical systems.
5. Structure and functions of cell membrane, ion transport through cell membrane.Irreversible thermodynamic treatment of membrane transport Nerve conduction
6. Enzyme kinetics and enzyme inhibitory reactions and their implications, Oscillatory reactions. (6)
7. Evaluation of size, shape, molecular weight aand extent of hydration of biopolymers by various experimental techniques. Sedimentation equilibrium, hydrodynamic methods: Diffusion, sedimentation velocity, viscosity, electrophoresis, rotational motions.Diffration methods: light scattering, low angle X ray scattering, X ray diffraction and photocorrelation spectroscopy.
8. Structural transition: Helix – cell transition, optical methods of studying transitions spectral methods. O.R.D. forces involved in structural stability.
9.Membrane equilibria: membrane systems, miscilles, bilayers structure and function.(3)

References:

1.Biophysical chemistry by Cantor and Schimmel Part I, Part II and Part III Treeman and Co.
2. Biophysical chemistry –J.L.Gurth and A.Gurth Pragati Prakashan 2009 3rd Edn

CH-415 Special topics in Nuclear Radiation Chemistry

1. Applications of radioisotopes in nuclear medicine and pharmaceuticals: general applications of radiopharmaceuticals, use of nuclear properties of indicator nuclides. In vivo diagnostic procedures, in vitro diagnostic testing therapeutic use of radiations. Use of radiation for food preservation and sterilization.
(10L)
2. The origin of chemical elements, cosmology, premordial nucleosynthesis, stellar evolution and stellar nucleosynthesis, solar nutrino problem, Synthesis of Be, B, Li in cosmos. (8L)
3. Management of radioactive waste: liquids, solids and gases (6L)
4. Separation of isotopes : General methods of isotope separation, separation of isotopes with special reference to heavy hydrogen, Lithium, Boron, Uranium. (7L)
5. Radiolysis of organic systems : Alkanes, aromatic hydrocarbons, alcohols (7L)
6. Techniques in nuclear chemistry : Targets for nuclear reaction, studies measurement of beam energies and intensities, target chemistry, preparation of samples for activity

measurement, carriers. (7L)
7. Radiolysis kinetics : Emperical rate studies, molecular kinetics, non-homogeneous kinetics, effect of solute concentrations on the molecular yields from water,radical scavenging,chain reactions, pulse radiolysis (7L)
8.Radiometric titrations : Principle techniques and titrations based on precipitate formation, complex formation and neutralization reactions (8L)

Text Books :

1. Radiation Chemistry: Principles and Applications, Farhataziz and M. A. J. Rodgers (Eds.), VCH Publishers, New York (1987).
2. Radiation Chemistry: Present Status and Future Trends, C. D. Jonah and B. S. M. Rao (Eds.) Elsevier, Amsterdam (2001).
3. Essentials of Nuclear Chemistry: H. J. Arnikar. New Age Publication Ltd. (1995).
4. Radiation chemistry and Nuclear Methods of Analysis W. D. Ehmann, D. E. Vance. John Wiley (1991).
5. Nuclear and Radiochemistry G. Friedelarder, J. W. Kennedy, E.. S. Macias, J. M. Miller John Wiley (1981).
6.Source Book of Atomic Energy, S. Glasstone, D. Van Nostrand (1967)
7.Nuclear analytical chemistry- J. Tolgyessy and S. Verga Vol. 2 , University park press (1972)

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SYLLABUS AND SAMPLE QUESTIONS

Subject Subject
Code No.

33 Chemical Sciences

[33] : CHEMICAL SCIENCES

The syllabus consists of two papers, as follows :
Paper II and Paper III will be of 75 minutes and 2½ hours duration respectiveoy. Paper II will be
of 100 marks and Paper III will be of 200 marks.

PAPER II

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

Dieckmann condensations ; Hofmann, Schmidt, Lossen, Curtius, Beckmann and Fries rearrangements, Reimer-Tiemann, Reformatsky and Grignard reactions. Diels-Alder reaction,
Claisen rearrangement, Friedel-Crafts reaction, Witting reaction. Routine functional group transformations and inter-convertions of simple functionalities. Hydroboration, Oppenauer oxidation,
Clemmensen, Wolf-Kishner, Meerwein-Ponndorf Verley and Birch reductions.
9. Elementary principles and applications of electronic, vibrational, NMR, EPR, Mossbauer and mass
spectral techniques to simple structural problems.
10. Data Analysis : Types of erros, propogation of errors, accuracy and precision, least-square analysis,
average standard diviation.

PAPER III

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

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8. **Ideal and Non-ideal Solutions :** Excess functions, activities, concept of hydration number,

activities in electrolytic solutions, mean ionic activity coefficient. Debye-Huckel treatment of dilute electrolyte solutions.

9. **Equilibria in Electrochemical Cells :** Cell reactions, Nernst equation, application of cell EMF measurements.

10. **Surface Phenomena :** Surface tension, adsorption on solids, electrical phenomena at interfaces including electrokinetic micelles and reverse micelles; solutions. Applications of photoelectron spectroscopy, ESCA and Auger spectroscopy to the study of surfaces.

11. **Statistical Thermodynamic probability and entropy :** Maxwell-Boltzmann distribution of velocities, average, most probable and root-mean-square velocities. Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics. Partition function, rotational, translational, vibrational and electronic partition functions for diatomic molecules, calculations of thermodynamic functions and equilibrium constants. Theories of specific heat for solids.

12. **Non-equilibrium Thermodynamics :** Postulates and methodologies, linear laws, Gibbs equation, Onsager reciprocal theory.

13. **Reaction Kinetics :** Methods of determining rate laws, Mechanisms of photo-chemical, chain and oscillatory reactions. Collision theory of reaction rates, steric factor, treatment of unimolecular reactions. Theory of absolute reaction rates, comparison of result with Eyring and Arrhenius equations, ionic reactions, salt effect. Homogeneous catalysis and Michaelis-Menten Kinetics; heterogeneous catalysis.

14. **Fast Reactions :** Study of kinetics by stop-flow technique, relaxation method, flash photolysis and magnetic resonance method.

15. **Macromolecules :** Number-average and weight-average molecular weights. Determination of molecular weights. Kinetics of polymerisation. Stereochemistry and mechanism of polymerisation.

16 **Solids :** Dislocations in solids, Schottky and Frenkel defects. Electrical properties. Insulators and semiconductors, band theory of solids, solid-state reactions.

17. **Nuclear Chemistry :** Radioactive decay and equilibrium. Nuclear reactions, Q value, crosssections, types of reactions. Chemical effects of nuclear transformations, fission and fusion, fission products and fission yields. Radioactive techniques, tracer techniques, neutron activation analysis, counting techniques such as G.M., ionization and proportional counters.

18. **Chemistry of Non-transition Elements :** General discussion on the properties of the nontransition elements, special features of individual elements, synthesis, properties and structure of their halides and oxides, polymorphism of carbon, phosphorus and sulphur. Synthesis, properties and structure of boranes, carboranes, borazines, silicates, carbides, silicones, phosphazenes, sulphur, oxyacids of nitrogen, phophorus, sulphur and halogens. Interhalogens, pseudohalides and noble gas compounds.

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

28. **Pericyclic Reactions :** Selection rules and stereochemistry of electrocyclic reactions, cycloaddition
and sigmatrophic shifts, Sommelet-Hauser, Cope and Claisen rearrangements.
29. **Heterocycles :** Synthesis and reactivity of furan, thiophene, pyrrole, pyridine, quinoline, isoquinoline and indole. Skraup synthesis, Fischer indole synthesis.
30. **Reagents in Organic Synthesis :** Use of following reagents in organic synthesis and fuctinal
group transformations-Complex metal hydride. Gilman's reagent, lithium, dimethylcuprate, lithim, disopropylamide (LDA) dicyclohexylcarbodimide, 1, 3-dithiane (reactivity umpolung).
Trimethy, silyl iodide, tri-n-butyltin hydride, Woodward and Prevost hydroxylation, osmium tetraoxide, DDQ, selenium dioxide, phase transfer catalysts, crown ethers and Merrifield resin.
Peterson's synthesis, Wilkinson's catalyst, Baker's yeast.
31. **Chemistry of Natural Products :** Familiarity with methods of structure elucidation and biosynthesis of alkaloids, terpenoids, steroids, carbohydrates and proteins, Conformations of proteins and nucleic acids.
32. **Bioorganic Chemistry :** Elementary structure and function of biopolymers such as proteins
and nucleic acids, Genetic code, Mechanism of enzyme action.
33. **Photochemistry :** Principles of energy transfer, cis-trans isomerization, Paterno-Buchi reaction,
Norrish Type I and II reactions, photoreduction of ketones, di-pi-methane rearrangement, photochemistry of arenes.
34. **Spectroscopy :** Combined applications of mass, UV-VIS, IR and NMR spectroscopy for structural elucidation of compounds.
SAMPLE QUESTIONS
PAPER II
1. The total number of permitted electrons in a 4f orbital is
(A) 10, (B) 6,
(C) 14, (D) 2. Ans. C
2. Which one of the following is a molecular solid ?
(A) NaCl, (B) Phosphorus,
(C) Diamond, (D) Iron. Ans. B
3. Thr chiral molecules among the following are
(i) 1, 1-Dimethylcyclopropane.
(ii) cis-1, 2-dimethylcyclopropane.
(iii) trans-1, 2-dimethylcyclopropane.
(A) All three, (B) (ii) and (iii), (C) only (ii), (D) only (iii). Ans. D

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PAPER III
1. The standard heat of hydrogenation of propane in the reaction
$CH_2 = CHCH_3(g) + H_2(g) = C_3H_8(g)$ is - 124 kJ/mol.
The standard heat of combustion of propane in the reaction
$C_3H_8(g) + 5O_2(g) = 3CO_2(g) + 4H_2O$ (1) is - 2220 kJ/mol.
Calculate the standard heat of combustion of propane.
Given : $\{H_2(g) + 0.5O_2(g) = H_2O(l), AH_o = -285.8kJ/mol\}$
2. Match the following Hammet $\int$ values :
(a) m - Me (i) + 0.78
(b) p - Me (ii) – 0.27

(c) p - NO_2 (iii) + 0.12
(d) p - $COCH_3$ (iv) – 0.07
(e) m - OMe (v) + 0.50
(f) p - OMe (vi) – 0.17

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

(i) $[Fe(CN)_6]4 + [IrCl_6]^{2-}$

(ii) $[Co(NH_3)_5NCS]^{2+} + [Cr(H_2O)_6]^{2+}$

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

M. Sc. Part II Analytical Chemistry
With Effect From 2009-2010
Structure of the Syllabus

Semester III

Compulsory Courses

CH-390 : Electro analytical and Current Analytical Methods in Industries.
CH-391 : Environmental and Analysis of Industrial Materials**.**
CH-392 : Advanced Analytical Techniques

Optional Courses-

CH-380 : Pharmaceutical Analysis
CH-381 : Medicinal Chemistry

Semester IV

Compulsory Courses

CH-481 : Bioanalytical and Forensic Science
CH-490 : Analytical Spectroscopy
CH-491 : Polymer Technology

Practical courses-

CH-387 : Practicals (Inorganic**)**
CH-487 : Practicals (Physical)
CH-488 : Practicals (Organic) **OR** CH-498**:** Project

NOTE: One Industrial Visit and report writing is compulsory.

CH-380 Pharmaceutical Analysis (60L)

Section -I

1) a) Sources of Impurities in Pharmaceutical Raw Materials and Finished Products: (2 L)

Raw materials, Method of manufacture, Contamination-atmospheric, particulate, cross contamination, microbiological, process errors, Packing errors, chemical instability, container contamination (in brief) physical changes, temperature effects. GMP

Ref 1. and Ref 4

b) Stability Studies, Shelf Life Fixation for Formulated Products (3 L)

2) Test and assay of raw materials and finished products :

a) Biological Assays : (06L)

Introduction, Precision of biological assays in brief, (estimation of errors is excluded) Biological assay of insulin, Tetanus antitoxin, Determination of proteolytic activity, Determination of ABO group and Rh group, Photometric haemoglobinometry, Haemolysins?

b) Chemical Tests and Assays: **(5 L)**

Limit test, characteristics of limit tests specificity sensitivity, control of personal errors Loss on drying (NaCl), loss on ignition (ZnO),limit test for lead, arsenic chloride and sulphate,

2

moisture determination by KFR titration method, assay of steroids, and identification of steroids (IP)

c) Analysis of vegetable drugs : (2 L)

Sampling, foreign organic matter, ash values and water soluble ash (ginger) Acid insoluble ash (Rhubarb), sulphated ash (Aspirin.)

d) Microbiological tests and assays: (7 L)

Microbiological assay of antibiotics, (std. preparations and units of activity, test organisms and inoculum, Apparatus, Method -Cylinder or cup plate method and two level factorial

assay ((ampicillin from table 4 I.P.) Microbial limit test {preliminary testing, Mediumsoyabean casein digest agar medium only)and total microbial count only }Test of sterility- Membrane filtration method , Determination of Thiomersal

e) Physical tests and assays (5 L)

Disintegration tests (tablets, capsules, pessaries and suppositories Dissolution tests- tablets, capsules. ***Reference1 and 2. (Relevant pages.)***

Section –II

3) Standardization and quality control of different dosage form: (25 L)

Brief introduction to different dosage forms with the IP requirements Analytical methods for the following- Tablets (aspirin) additives used in tablet manufacture, capsules Rifampicin) Powders (Sodium benzoate), Solutions (saline NaCl) Suspensions(barium sulphate –limit test for impurity) Mouthwashes(Ointments (salicylic acid) and creams Dimethicone by IR) Injections (Mannitol) , ophthalmic preparations (sulphacteamine),Aerosols (salbutamol), Blood products and reporting protocols.

Reference 1 and 2 (Relevant pages)

4) **Role of FDA in pharmaceutical industry. (5 L)**

Drug cosmetic act Definitions Drug, Misbranded , Adulterated and Spurious drug, New drug Cosmetics ,Blood bank, Manner of labeling, GMP in brief (Schedule M), FDA. Role of FDA, introduction to new drugs, brief summary of different phases of test and approval for formulation of a drug.

Reference 3

Reference 4 Pages 21,22,23,26, 74, 75,140-144

References:-

1) Practical Pharmaceutical chemistry third edition volume 1. By A.H.Beckett & J.B.Stenlake

2) Pharmacoepia of India Volume I and II.

3) Remington's Pharmaceutical sciences.

4) Forensic pharmacy by B.S Kuchekar, A.M Khadatare (Nirali Prakashan)

5) Practical pharmaceutical analysis by Ashitosh Kaur

6) Analytical problems of drug substances and Exp by Florey

7) ***The theory and practice of Ind pharmacy Leon lachmann,Herbert Liebermann and Joseph L.Karnic 3rd edition By Varghese Publication House, Hind Rajasthan Building Dadar Mumbai –14***

3

CH-381 Medicinal Chemistry

Section-I

Drug Design (30 L)

Part A

Definition of drug, Classification of drug on the basis of therapeutic action, pharmocophonic API (Active pharmaceutical ingredient) chiral drugs, Development of new procedures followed in drug

design, Concept of pro-drug and soft-drug, Factor affecting bioactivity, Resonance, Inductive effect, isosterism, bio-isosteris, spatial considerations. **(5 L)**

Part B:

Theories of drug activity, occupancy-theory, rate theory, induced- fit theory, Quantitative structure- activity relationship, History and development of QSAR, Concept of drug receptors, Elementary treatment of drug receptor interactions. **(5 L)**

Part C:

Physicochemical parameters lipophilicity, partition- coefficient, electronic ionization constant, steric,Shelton and surface activity, parameters and redox potential**. (5 L)**

Part D:

Evaluation Methods: Free- Wilson Analysis, Hansch-analysis, relationship between Free-Wilson

and Hansch-analysis – LD50 ED50 (mathematical derivation of equation excluded).
(5 L)
Part E:
Assay of drugs (6 L)
1) Chemical assay- Wet and instrumental methods
2) Biological assay
3) Immunological assay
Part F:
Pharmacokinetics/ Pharmacodynamics
Drug absorotion, disposition, elimination, important pharmacokinetic parameters in defining drug disposition and in theraupetics, uses of pharmacokinetics in drug development process, Novel Drug delivery systems. **(4 L)**
Section-II (30 L)
1) Antineoplastic Agents: Intrcduction, Cancer, chemotherapy, Role of alkylating agents and antimetabolites in treatment of cancer, Mention of carcinolytic antibiotics and mitotic inhibitors of mechlorithamine, cyclophosphamide melphalan, uracil, mustards and 6 – mercapto-purine Recent development in cancer chemotherapy. Hormones and natural products.
(6 L)
2) Cardiovascular Drugs: Introduction cardiovascular diseases. Drug inhibitors of peripheral symphatetic function. Central intervention of cardiovascular output direct acting artenolar dilators. Synthesis of amyl-nitrate, sorbitrate, diltiazel, quinidine, verapamil, methyldopa atenolol, oxyprenolol. **(6 L)**
4
3) Local Antifective Drugs: Introduction and general mode of action, sulphonamides, forazalidione, nalidixic acid, ciprofloxacin, norfloxicin, dapsone, aminosalicylicacid, isoniazid, ethionamide, ethambutal, econozole, griseoflulvin, chloroquin, and primoquin.
(5 L)
4) Psychoactive Drugs: Introduction neurotransmitters, CNS depresents, general anaesthetics mode of action of hypnotics, sedatives, anti-anxiety drugs, benzodiazepines, buspirone, neurochemistry of mental diseases, antipsychotic drugs, the neuroleptics, antidepressants, butyrophenones, serendipity and drugs development. Sterochemical aspects of psychotropic drugs, synthesis ofdiazepam, oxazepam, chlorazepam, alprazolam, phenytoin, ethosuccimide,trimethadione, barbiturates, thiopental sodium, glutethimide.
(9 L)
5) Antibiotics: Cell well biosynthesis, inhibitors, β- lactamrings antibiotics inhibiting protein synthesis. Synthesis of penicillin G, penicillin 5, ampicilin, amoxicillin, chloramphenicol, cephalosporin, tetracycline, streptomycin. **(4 L)**
References:
1) Introduction to medicinal chemistry. A. Gringuage, wiley-VCH.
2) Wilson and Gisvoldis text books of organic medicinal and pharmaceutical chemistry, Ed Robert
F. Dorge.
3) An introduction to Drug design, S.S. Pandeya and I R Dummeck, New Age International
4) Burgers medicinal chemistry and drug discovery vol- 1(chapter 9 and 14).
5) Goodman and Gilmans pharmacological basis of therapeutics, McGraw-Hill.
6) The organic chemistry of Drug synthesis and Drug action,R.B.silverman, academic press.
7) Strategic for organic drug synthesis and Design, D. Lednicer, John wiley.
8) Organic chemistry of Drug synthesis, Lednicer and Meiser, wiley, 5 volume.
9) Comprehensive medicinal chemistry 5 volume, merck index, 13th volume.
10) Encyclopedia of analytical chemistry 16 volume, R.A.Meyers.
11) Encyclopedia of industrial chemical analysis (Wiley-I science)
5
CH-390: Electrochemical and current Analytical Methods in Industries.

Section-I

Electrochemical Methods of Analysis (30 L)

1) Voltammetry and polarographic methods of analysis.

Voltammetry and polarography, electrodes, polarographic principles, Ilkovic Equation, factors affecting on polarographic wave, pulse polarography, differential pulse polarography, square wave polarography, Voltammeric principle, cyclic Voltammetry, criteria of reversibility of electrochemical reactions, quasi-reversible and irreversible processes, qualitative and quantitative analysis by these techniques. **(12 L)**

2) Stripping Voltammetry:

Adsorptive stripping Voltammetry and electrogravimetry. **(4L)**

3) Coulometry:

Instrumentations, coulometric titrations, advantages and limitations. **(6L)**

4) Amperometry:

Principle, Instrumentation, typical applications, amperometric titrations, chrono-amperometry and chrono-potentiometry. **(5L)**

5) Nanoscience:

Synthesis of Nanomaterial by electrochemical deposition method, general applications of nanometerial. **(3L)**

Section-II

Current Analytical Methods of Analysis in Industries. (30 L)

1) Radioanalytical Methods of Analysis

a) Activation analysis:

Neutron activation analysis, principle, technique, steps involved in neutron activation analysis. Radiochemical and instrumental methods of analysis, important applications of NAA. **(6L)**

b) Isotope dilution analysis:

Principle, types of isotope dilution analysis, typical applications of isotope dilution analysis. **(5L)**

c) Radiometric titration:

Principle, techniques based on complex formation and precipitation, radiometric titration curves for estimation of ions from their mixture. **(3L)**

d) Radio-reagent methods of analysis:

Principle, technique, application and limitation. **(3L)**

6

2) Radiation scattering methods of analysis:

(Turbidimetry and Nephelometry) principle, instrumentation and typical applications. **(3L)**

3) Thermal methods of analysis:

Principle, instrumentation of TGA, DTA, DSC and EGA, thermometric titrations, typical applications of each technique. **(7L)**

4) Spectro-electrochemistry:

Principle, applications, chemically modified electrodes and electrochemical sensors. **(3L)**

References:

1) Introduction to instrumental analysis by R.D.Broun, Mc Graw Hill (1987)

2) Instrumental methods of chemical analysis by H. willard, L.Merrit, J.A. Dean and F.A. settle. Sixth edition CBS (1986)

3) Thermal analysis by W.W. Wendlandt, John Wiley, (1986)

4) Fundamentals of analytical chemistry by D.A.Skoog, D.M. West and H.J. Holler sixth edition (1992)

5) J. chemical education, 60,302 to 308 (1983)

6) Cyclic Voltammetry and frontiers of electrochemistry by N.Noel and K.I. Vasu IBH, New delhi (1990)

7) Source book of Atomic energy by Glasstone.

8) Principle of Activation Analysis- P. Kruger, John Wiley and sons, (1971).
9) Nuclear Analytical Chemistry – J. Tolgyessy and S. Verga vol. 2, university Park press, (1972)
10) Radiochemistry and Nuclear methods – W.D. Ehmann and D.E. Vance, John Wiley and Sons.
7

CH-391: Environmental and Analysis of Industrial Materials

Section-I (30L)

1) Analysis of Fertilizers:

Sampling and sample preparation, analysis of nitrogen, phosphorus and potassium. Nitrogen: urea nitrogen, total Kjeldahll nitrogen methods, Ammonia nitrogen. Phosphorus: total phosphorus, available and non-available, alkalimetric ammonium molybdophosphate method. Potassium: potassium by sodium tetraphenyl borate method. **(5 L)**

2) Analysis of ceramics and glass:

Sodium and potassium by flame photometry, analysis of lead and borate glasses, analysis of Cr, Mn, Fe, Co, Ni, and Zn by X-ray. **(4 L)**

3) Analysis of detergents:

General scheme of analysis, sampling, alcohol soluble materials, test for unsulfonated on sulfated materials. **(5 L)**

4) Analysis of cosmetics:

Analysis of deodorants and antiperspirants, Al, Zn, boric acid, chloride, sulphate, urea. Analysis of face powder: fats, fatty acid, Ca, Mg, $BaSO_4$, Ti and Fe. Oxides of Ti, Fe and Al (total). Analysis of hair tonic preparations: 2, 5-diaminotoluene, $KBrO_3$, resorcinol, salicylic acid. **(4 L)**

5) Analysis of paints and pigments:

Preliminary inspection of sample, Tests on the total coating, Separation of Pigment, Binder and Thinner of Latex Paints, Separation of Pigment, Binder and Thinner of Solvent Type Coatings, Identification of Binder, Identification and Analysis of Pigments, Identification and Analysis of Thinner. **(6 L)**

6) Analysis of Explosives:

General Methods:- Heat of Explosion, Hygroscopicity, Moisture by Karl Fischer Titration, Qualitative tests of explosives, Quantitative Analysis of Explosive Mixtures, Dynamites, Blasting Caps and Electric Detonators, Primers, Liquid Propellants and Solid Propellants. **(6 L)**

Section-II (30L)

Metallurgy and Geochemistry

1) Analysis of Geological materials:

Dolomite, Ilmenite and bauxite. **(5 L)**

2) Analysis of Industrial materials:

a) Steel, b) copper based alloys c) aluminum based alloys. **(5 L)**

8

3) Industrial Waste Water Analysis:

a) Chemical analysis:

Procedure, preservation of sample, sampling characterization of waste water, analysis of DO, COD, BOD, Arsenic, Mercury, Chromium-hexavalent, Lead cyanide, total suspended solids. **(6 L)**

b) Biological wastewater treatment:

Activated sludge process, trickling, filtration, rotating biological contactors and anaerobic decomposition. **(6 L)**

c) Air pollution:

Suspended particulate matter, aerosol, generation, hazards and control of SO_x, NO_x, CO_x, air monitoring equipments, cyclone separator, electrostatic precipitator, filters and setting chambers. **(4 L)**

d) Sludge analysis and method of disposal. (2 L)
e) Safety rules and methods in industries. (2 L)
References:
1) Standard methods of chemical analysis, volume 3, part-B, F.J. Welcher.
2) Cosmetics by W.D. Poucher (Three volumes)
3) Insight into speciality inorganic chemicals by D. Thomson, the royal society of chemistry (1995)
4) Industrial water pollution control by W.W. Ecken and elder, Tata McGraw-Hill (2000)
5) Applied chemistry, a text book for Engineers and technologists by H.D. Gesser.
6) Handbook of Industrial chemistry, by Davis Berner.
7) Air pollution by Rao and Rao
8) Standard methods of water and waste water analysis by A.K. De.
9) Standard Methods of Chemical Analysis, Sixth Edition, Volume two-Part B
Frank J. Welcher.
10) Quantitative analysis by vogels.
9
CH-392: Advanced Analytical Techniques
Section I (30L)
Basic Electronics and Automation in Chemical Analysis
1) Introduction to components: (15 L)
a) Resistors, conductance, capacitors, inductors, transformers, charging and discharging of condensers, DC circuits, complex DC circuits, simple parallel circuits, current and potential measuring devices, AC circuits, reactance and capacitance, RL circuits, problems based on circuits and components. Ohms law, Kirchhoffs law, Faradays law of electrolysis and its applications, problems based on electro deposition. ***Ref. 1***
b) Introduction and applications of semiconductors, diodes and its applications, zener diode and its use in voltage regulation. Light emitting diodes, photodiodes, photo resistors, transistors and amplifiers, (only its meaning and applications) introduction to digital computers, binary numbers, decimal numbers and their conversions. ***Ref. 1***
2) Role of Computers and Microprocessors in Analytical Chemistry:
Introduction, computers and microprocessors, instrument-computer interfaces. The scope of microprocessor control to various laboratory instruments- liquid chromatography, Atomic absorption spectrophotometer, potentiometer and X-ray spectrometer.
Ref. 7. page No. 491 to 512 **(5 L)**
3) Automated Analysis:
Automated laboratory analyses, Laboratory apparatus- Continuous flow analyzers, Flow injection analyzers, Discrete-sample analyzers, Centrifugal force analyzers, Process control, process control analyzers, Automatic titrators.
Ref.1. page No.949 to 976 **(10 L)**
Section-II (30L)
1) Atomic spectroscopy based on flame and electro thermal atomization:
Theory, sources, burners, atomic emission spectra, atomic absorption spectra, effect of temperature on emission, absorption and fluorescence, electro thermal atomizers, radiation sources atomic absorption methods, instrumentation for AAS, spectral interferences, standard addition and internal standard method of analysis, comparison of atomic absorption and emission methods, inductively coupled plasma and direct current plasma emission spectroscopy, atomic and molecular mass spectrometry including ICP-MS and tandem mass spectroscopy, MS-MS principle, instrumentation and analysis of micronutrients like Mo, B, Cu, Zn essential towards the healthy growth of crops, fruits, determination of these micronutrients from soils, plants and fruits. **(10 L)**
2) Laser Based techniques:
Atomic fluorescence spectroscopy, resonance ionization spectroscopy, laser enhanced ionization, principle, types of transition tunable laser, classification of medium pumping and

controlling mechanism, instrumentation, detecting of various gases, liquid and solids, sources, cell, monochromators, detector. **(7 L)**

10

3) Radiochemical Techniques:

Radioimmunoassay, its principle and applications, instrumentation for radiobioassay, clinical application of the radioimmunoassay of insulin, Estrogen and progesterone, receptor techniques of breast cancer. Enzyme- linked immunosorbent assay (ELISA), principles, practical aspects, applications. **(10 L)**

4) Supercritical fluid chromatography (SFC):

Principle, Instrumentation and applications in pharmaceuticals. **(3 L)**

References:

1) Introduction to instrumental analysis by R.D.Broun, Mc Graw Hill (1987)

2) Instrumental methods of chemical analysis by H. willard, L.Merrit, J.A. Dean and F.A. settle. Sixth edition CBS (1986)

3) Radio-bioassay by faund S. Ashkar, volume-I, page 1-35 and 53 to 65 CRC press, Inc. Boca Raton, Florida.

4) Practical clinical biochemistry by Harold Varley, fourth edition, CBS publication, New Delhi.

5) Immunology by I Roitt, J. Brostoff, D. Male, Mosby publisher, 5th edition (1998)

6) Instrumental methods of chemical analysis by Chatwal and Anand.

7) Fundamentals of Analytical Chemistry, 6th edition, D.A. Skoog, D.M. West and F.J. Holler, Saunders college publishing.

8) Principle and practice of Analytical Chemistry by F.W. Fifield and D. Kealey 3rd edition, Blackie and sons Ltd.

11

CH- 481 Bioanalytical and forensic science

Section-I Bioanalytical (30 L)

1) Body fluids: (10 L)

Composition and detection of abnormal levels of certain constituents leading to diagnosis of diseases. Analysis of physiological fluids- urine, blood and serum physiological and nutritional significance of water soluble and fat soluble vitamins, minerals and analytical techniques for vitamins including microbiological techniques.

2) Human-nutrition: (5 L)

Estimation of enzymes, carbohydrates, essential amino acids, proteins and lipids.

3) Food Analysis: (12 L)

a) Nutritional value of foods, idea about food processing and food preservations.

b) Analysis of food such as milk, milk products, tea, coffee and beverages. Flour, starch, honey, jams and edible oils. Analysis of preservatives, coloring matter, micronutrients.

4) Food processing and food preservation: (3 L)

Refining milling, canning, concentration, freezing Drying, pasteurisation sterilization irradiation. ***Ref. 8. Pages 446-452***

Section-II

Toxicology and Forensic Science (30 L)

a) Toxicology: (20 L)

Isolation, identification and determination of following

1) Narcotics- heroin and cocaine.

2) Stimulants- caffeine, amphetamines.

3) Depressants- Barbiturates, Benzodiazepines.

4) Hallucinogens- LSD

b) Forensic Science: (10 L)

1) Medicinal and toilet preparations Act.

Definition alcohol, Medicinal preparation toilet preparation, Denatured spirit bonded manufactory Non bonded manufactory, Narcotic, Opium, exemption from duty Classification of med. and toilet preparations containing alcohol. ***Ref. 7. Relevant pages***

2) Narcotics and Psychotropic substances Act.

Def – addict, cannabis (hemp), Coca derivative, coca leaf, Manufacture medicinal cannabis, narcotic drug, opium , opium derivative, opium poppy, poppy straw, psychotropic substance Illicit traffic, Prohibition control regulation offence and penalties. ***Ref. 7. (Points 1, 2,3,4,5 and13)***

References:

1) Analytical chemistry of foods by Ceiwyn S. James.
Blackie academic and professional- Chapman and Hill publisher, madras 1st edition.
2) Introduction to food science and technology, food science and technology series by G.F. Stewart and M.A.Amerine, academic press.

12

3) Chemical analysis of food by pearson.
4) Practical Biochemistry in clinical Mdicine- R. L Nath, Academic Publshers 2nd Edn (1990)
5) Texbook of Forenisc pharmacy- B. M. Mithal 9th Edn (1993) National Centre, Calcutta.
6) V. Malik, Drug and Cometics Act.
7) Forensic pharmacy by B.S Kuchekar, and A.M Khadatare Nirali Prakshan)
8) Shreves' Chemical Process Industries fifth edition by George Austin Mg Graw Hill
9) Practical Pharmceutical Chemistry by Beckett

CH-490 - Analytical Spectroscopy

Section I (30L)

1) Introduction:

Electromagnetic radiation, properties, Interaction of radiations with matter, classification of analytical method based on EMR spectrum. **(2 L)**

2) Instrumentation:

Sources of radiations, monochromators, sample containers, detectors for various types of radiations. **(5 L)**

3) Electron spectroscopy:

Principle of ESCA. ESCA satellite peaks, chemical shifts, instrumentation, typical analytical applications. **(5 L)**

4) Ultraviolet photoelectron spectroscopy:

Principle, Instrumentation and analytical applications **(2 L)**

5) X- ray Methods of Analysis:

Principle, Theory- X-ray spectral lines, X-ray tube. X-ray Absorption, X-ray Diffraction, X-ray Fluorescence- instrumentation, qualitative and quantitative analysis, numerical problems. **(10 L)**

6) Chemiluminescences:

Introduction, principle, types. Measurement of chemiluminescence, Instrumentation quantitative chemiluminescences. Gas phase chemiluminescence's analysis. Chemiluminescences titrations. Electro-chemiluminescence. **(6 L)**

Section II (30 L)

7) Nuclear magnetic resonance spectroscopy:

Introduction, theory, Instrumentation, Chemical shifts. Spin-spin Splitting, solvents. Qualitative and quantitative analysis. Non protonic NMR spectra, Multiple resonance, Nuclear overhauser effect, solid samples in NMR, Kinetic studies with NMR, Limitations of NMR spectroscopy, 2-D NMR, Magnetic Imaging. **(15 L)**

8) Electron Paramagnetic resonance spectroscopy:

Introduction, theory, Instrumentation, Spin-spin coupling, Qualitative and quantitative analysis, multiple resonance, Spin labeling, metallic complexes, other uses of EPR spectroscopy. **(12 L)**

13

9) Electron Microscopy:

Introduction, Principles, Instrumentation, Applications. **(3 L)**

References:

1) Introduction to instrumental analysis by R. D. Braun, MC. Graw Hill- International edition.
2) Analytical spectroscopy by Kamalesh Bansal- First edition.
3) Instrumental methods of chemical analysis by Willard, Dean and Merittee- Sixth edition.
4) Analytical chemistry principles by John H. Kenedey- Second edition, Saunders college publishing.
5) Electron microscopy in the study of material, P. J Grundy and G. A Jones, Edward Arnold.
6) Standard methods of chemical analysis- F. J. Welcher, part-B sixth edition (1966) D. van Nosrtand Company. Inc. 19

CH-491 Polymer Technology

Section I (30L)

1) Genesis of Polymers:

Brief history, what are polymers? How are polymers made? Classification of polymers. The role of polymers in society and the environment **(2 L)**

2) Chemistry of polymerization:

Chain polymerization, step polymerization, copolymerization, miscellaneous polymerization reactions, Polymerization techniques-Bulk, Solution, Suspension, Emulsion polymerization, Melt polycondensation, Solution polycindensation, Interfacial condensation, Salient features of different polymerization techniques. **(8 L)**

3) Individual polymers:

Preparation and applications of following polymers- Polyethylene, Polystyrene, Polyester, polyformaldehyde, Polycarbonate, Polyurethane, Polyamides, Polyethylene glycol, Polyvinyl acetate, Polyvinyl alcohol, polyvinyl chloride (PVC) Teflon, Polyisoprene, Polybutadine, Phenol- formaldehyde resin, Urea- formaldehyde resin, Epoxy polymers, Silicone polymers, Rayon, Cellophane, Cellulose nitrate, Cellulose acetate. **(5 L)**

4) Polymer reactions:

Hydrolysis, Acetolysis, aminolysis, hydrogenation, addition and substitution reactions, reactions of specific groups such as –OH, - COOH, >C= and other groups, Cyclisation reaction, cross linking reactions, reaction leading to graft and block co-polymers. **(3 L)**

5) Kinetics and mechanism of condensation reaction:

Chain reaction and co-polymerization reaction, Radiation induced polymerization. Kinetics study and mechanism of polymerization in the liquid and solid phases, effect of radiation on polymers degradation and crosslinking. **(8 L)**

6) Polymer degradation:

Polymer degradation, Types of degradation – Thermal, mechanical, ultrasonic waves, photo, high energy degradation, oxidative, hydrolytic, biodegradation, environmental implication of polymer degradation. **(4 L)**

14

Section II (30L)

6) Analysis and testing of polymers: (10 L)

a) Chemical analysis of polymers:
X-ray diffraction analysis, thermal analysis, TGA, DTA.
b) Physical testing of polymers:
Mechanical properties, Fatigue testing, impact testing, tear resistance, hardness, abrasion resistance.
c) Thermal properties: Softening temperature, flammability.
d) Optical properties: transmittance, colour, gloss, haze and transparency.
e) Electrical properties: dielectric constant and loss factor, resistively, dielectric strength, electronic properties.
f) Chemical properties: resistance to solvents, vapour permeability, weathering.

7**) Measurement of molecular weight and size: (8 L)**

End group analysis, colligative properties measurements, solution viscosity and molecular size.

8) Polymer processing techniques: (8 L)

Plastics, elastomers and fibers, compounding, processing techniques- calendaring, die-casting,

film casting, compression moulding, injection moulding, blow moulding, extrusion moulding, thermoforming, foaming, reinforcing, hand lay-up technique, filament winding technique, spray-up technique, fiber spinning, melt spinning, dry spinning, uniaxial orientation, post treatment of fibers.

9) The sol-gel process and ceramics: (4 L)

The basic chemistry of sol-gel process, gelation, aging and structure development, sol-gel and aqueous chemistry of metal oxide, optical material.

References:

1) Textbook of polymer science 3rd edition by F.W.Billmeyer (1994).
2) Principles of polymer systems by F. Rodrigue, Tata Mc Graw Hill, New Delhi.
3) Principles of polymer systems by P.J.Flory, Cornell University press, New York.
4) Polymer chemistry-an introduction Seymour-Carraher-Marcel Dekker. Inc. New York.
5) Polymer Science by V.R. Gowarikar, N.B. Vishvanathane, New Age International Ltd. publisher (1998)
6) Polymer Science by Vasant Gowarikar, Wiley Easteren New York (1998).
7) Principle of polymer science, Bahadhur and sastri, Narosa publishing house.

15

CH-387 Practical course – I (Inorganic)

Perform any eighteen experiments of following:

1. Analysis of Dolomite with respect to a) Calcium b) Magnesium c) SiO_2.
2. Analysis of bauxite ore with respect to a) mixed oxide b) Iron c) aluminum.
3. Analysis of Bronze with respect to a) Copper b) Tin.
4. Estimation of COD from waste water.
5. Analysis waste water with respect to a) alkalinity b) T.D.S. c) sulphate d) dissolved chlorine.
6. Estimation of Nitrogen from given fertilizer by Kjeldahll method.
7. Estimation of Phosphorus from given fertilizer by volumetry / colorimetry.
8. Estimation of Potassium from given fertilizer by gravimetry / Flame photometry.
9. Estimation of calcium in the sample of dairy whitener by flame photometry.
10. Estimation of sodium in the sample of dairy whitener by flame photometry.
11. Analysis of Borax by conductometry.
12. Volumetric determination of sugar by copper reduction (volumetric).
13. Determination of iron in syndets by colorimetric.
14. Analysis of pigments with respect to Zn and Cr.
15. Determination of alcohol from beverages spectrophotometrically using dichromate.
16. Determination of alcohol in beverages by gas chromatographic technique.
17. To study the oxidation of Ferrocene and reduction of $K_3[Fe(CN)_6]$ by Cyclic Voltammetry.
18. Separation and molecular weight determination of protein by gel electrophoresis.
19. Thermo gravimetric analysis: composition of $CaCO_3$ and $MgCO_3$ in mixture.
20. To estimate the amount of paracetomol and dichlofenac sodium in caftol tablets (USP) by HPLC technique.
21. Limit test for Chloride / sulphate / lead / Iron.
22. Dissolution test of tablets.

16

CH-487 Practical Course II (Physical)

CH-487 Practical Course II (Physical)

Perform any eighteen experiments of following:

1. To determine amount of each para nitro-phenol and meta nitro-phenol from the given mixture by spectrophotometric titration using standard solution of NaOH.(λmax=280nm)
2. To determine the amount of each copper and bismuth or copper and iron (III**)** from the given mixture at 745nm by spectrophotometric titration using standard solution of EDTA.

3. To record ultraviolet adsorption spectrum of acetone in n-hexane and identify the various transition by Spectrophotometry.
4. Estimation of aspirin, paracetamol and caffine from APC tablet by UV-Visible spectrophotometry.
5. Determination of relative strength of acetic acid, chloroacetic acid and trichloroacetic acid through measuring their Ka-value by conductivity measurement method.
6. Determination of the pK_a value of chloro-acetic acid and tri-chloro acetic acid by potentiometry / pH-metry using standard solution of NaOH.
7. Determination of concentration of each sulphuric acid, acetic acid and copper sulphate from their mixture by conductometric titration with standard NaOH.
8. Determination of strength of acetic acid from the commercial vinegar sample by potentiometric tiration and its confirmation by conductometric / pH-metric titration using standard solution of NaOH.
9. Determination of strength of commercial phosphoric acid by potentiometric / pH-metric titration up to three equivalence point using standard solution of NaOH.
10. Estimation of various transition elements like Zn/Ni/Co/Cd/Al from various commercial samples by complexometric titration on potentiometry by using mercury electrode system.
11. Flame photometric estimation of each Na, K, Li and Ca from the given sample mixture by calibration curve method.
12. Flame photometric estimation of Na/ K/ Li/ Ca from their given sample by working curve method and its confirmation by standard addition method.
13. Flame photometric estimation of Na and K / Ca and K/ Na and Li from their binary mixture by standard addition method.
14. Estimation of Na and K / Ca and K from the binary mixture by internal standard method using lithium as internal standard on flame photometry.
15. Determination of amount of Zinc from the given sample solution by Nephelometric / Turbid metric titration using standard solution of $K_4[Fe(CN)_6]$ in 0.4M HCl.
16. Determination of amount of sulphate from the given sample solution by Nephelometric / Turbid metric titration using standard solution of $Ba(NO_3)_2$ or $Pb(NO_3)_2$.
17. Determination of amount of chloride from the given sample solution by Nephelometric/ Turbid metric titration using standard solution of $AgNO_3$.
18. Photofluorimeteric determination of Quinine / Riboflavin / aluminum from unknown sample by working curve method and its confirmation by standard addition method.
19. Estimation of Zn and Cd from the unknown solution by polarographic technique.
20. Estimation of Zn and Cd from their mixture by polarographic technique.
21. Estimation of Ca and Mg from the mixture of their oxalate by recording their TGA curve.
22. Recording a TGA curve for a mixture of $CuSO_4$ and NaCl, find out the percentage of each constituent in the mixture.
23. Estimation of As, Pb, Se, Cr, Zn, Cu, Al, Ni, Fe and some important transition elements from the commercial samples by Atomic absorption spectrometry with working curve and standard addition method.
24. Determination of moisture content in food sample by Karl fisher reagents.

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CH-488 Practical Course III (Organic)

Perform any eighteen experiments of following:

1. Determination of glucose from blood serum (enzyme method)
2. Determination of cholesterol and HDL Cholesterol in blood serum by kit method / colorimetry.
3. Estimation of Urea from blood sample (kit method).
4. Estimation of Tannin from tea.
5. Estimation of HMF from Honey.
6. Estimation of Salbutamol sulphate from Asthma inhaler.
7. Estimation of blood-glucose by Folin-Wu-method.

8. Isolation of caffine from tea.
9. Estimation of aspirin/ paracetamol /caffine from APC tablet.
10. Assay of Thiamine.
11. Assay of Local anesthetics. (I P)
12. Assay of soaps and detergents.
13. Assay of sulpha drugs.
14. Assay of polymers and plastics.
15. Estimation of Ketone bodies.
16. Estimation of creatine / creatimine in urine.
17. Estimation of total carbohydrates by Anthrone method.
18. Quantitative analysis of mixture by Gas Chromatography a) Chloroform and carbon tetrachloride b) methanol and ethanol.
19. Preparation of sulphanilamide from acetanilide (Organic Vogel).
20. Preparation of Methyl Salicylate and assay its purity (Organic Vogel)
21. Isolation of lycopene from tomato or β – Carrotene from Carrots (Ikan).
22. Preparation, purification and assay of aspirin.
23. Isolation of casein from milk.
24. Estimation of Vitamin-C by 2,6 dichloro-indophenol method.

Reference books:

1. Organic Laboratory technique a micro scale approach by Donald L. Pavia,Gary M. Lampman, George S. Kriz, Randall G. Engel second edition.
2. Practical clinical Biochemistry, Harold Varley (4th Edition), CBS publishers and Distributers. New Delhi -110002.
3. R. Ikan; natural products.
4. Peach and Tracy; Methods of Plant analysis Vol- VII.
5. Pavia and others; Orgaic Laboratory Techniques, (Second Edition,1995), Sannders Series (Harcofst Brace

Note: All organic compounds used as drugs prepared here will be purified and assayed for purity by standard IP/BP/VSP methods.

M.Sc. Chemistry Part- I

The following will be the structure for Revised Syllabus from June 2008 for semester I and Semester II

Semester – I

CH – 110 Physical Chemistry – I
CH – 130 Inorganic Chemistry – I
CH – 150 Organic reaction mechanism and stereochemistry.
CH – 107 Physical Chemistry practical (Departmental Course)
CH – 127 Inorganic Chemistry Practical (Departmental Course)

Semester – II

CH – 210 Physical Chemistry II
CH – 230 Inorganic Chemistry II
CH – 250 Synthetic organic Chemistry and Spectroscopy.
CH – 290 General Chemistry (Departmental Course) elective)
CH – 247 Organic Chemistry practical (Departmental Course)

Structure of
M.Sc. Part – II :- ORGANIC CHEMISTRY

SEMESTER : - III –

1. CH – 350 Organic Reaction Mechanism
2. CH – 351 Spectroscopic Methods in structure Determination
3. CH – 352 A Organic Stereochemistry.
B. Green Chemistry, Microwave reactions.
4. CH – 353 Pericyclic Reactions, Free radicals and Photo Chemistry.

SEMESTER :- IV –

1. CH – 450 Chemistry Of Natural Products.
2. CH – 451 Synthetic Methods in Organic Chemistry
3. CH – 452 Heterocyclic Chemistry; Chiron Approach; Medicinal Chemistry;
Vitamins, Hormones Antibiotics etc.
4. CH – 453 Organic Molecules related to Nano matelial.

Practical Courses:-

1. CH – 347 Ternary Mixture Separation
2. CH – 447 Two Stage Preparations.
3. CH – 448 Project / Preparations

Important Notes

1. Each theory course prescribed for M. Sc. should be covered in 4 periods, each of 60 minutes duration per week per course including lectures, tutorials, seminars etc.
2. Each practical course will require 6 hours of laboratory work per week and the course will be extended over two semesters and will be examined at the end of the year.
3. There should not be more than 10 students in a batch for M. Sc. practical course.
4. For theory course the question paper should include at least 20 % weight age for problem solving. Problem solving would include numerical, short answer, long answer questions to test understanding of the subject.
5. Of the 60 lectures in each course about 10 lectures will include tutorials, student seminars and class tests.
6. Two interactive sessions per course per semester must be conducted by

concerned teachers.

PHYSICAL CHEMISTRY CH – 110

SECTION – I

TEHRMODYNAMICS

1) Recapitulation :-

Heat, Work, & Conservation of energy – The basic concepts, the first law, infinitesimal changes, mechanical work, work of compression & expansion, free expansion, Expansion against constant pressure, reversible expansion, Heat :- heat capacity, enthalpy.

State functions & differentials – state functions, Exact & Inexact differential, changes in internal energy, temperature dependence of the internal energy, Temperature dependence of the enthalpy. Work of adiabatic expansion- Irreversible adiabatic expansion, reversible adiabatic expansion.

Ref 1 Page No. 38 to 74 Periods – 02

2) The Second law of Thermodynamics

Measuring the dispersal the entropy, The second law, the definition of entropy, the entropy changes in the system, natural events. Entropy changes in the universe – The enthalpy change when a system is heated, Entropy changes in surroundings, The entropy of phase transition, The entropy of irreversible changes.

Concentrating on the system – The Helmoltz & Gibbs function, some remarks on the Helmholtz function, Maximum work, some remarks to Gibbs function 2.4 Evaluating the entropy & Gibbs function, The Third law of Thermodynamics, Third law entropies standard molar Gibbs function.

Ref 1 Page No. 96 to 117. Periods – 05

3) Combining First & Second Law –

One way of developing the fundamental equations Properties of Gibbs function, The temperature dependence of the Gibbs functions, The pressure dependence of the Gibbs functions, The Chemical potential of a perfect gas, The open system & changes of composition.

Ref 1 Page No. – 121 – 127, 131. Periods – 03

4) Changes of State :

Physical Transformation of pure materials. The stability of phases, Phase equilibrium & phase diagrams, The solid – liquid boundary, The liquid-vapour boundary, The solid- vapour boundary, The solid-liquid-vapour equilibrium.

Ref. 1 Pages – 137 to 143. Periods – 03

5) Changes of State

Physical transformation of simple mixtures, Partial molar quantities Partial molar volume, Partial molar Gibbs function, The thermodynamics of mixing – the Gibbs function of mixing after thermodynamics mixing functions, The chemical potential of liquid-liquid mixture, colligate properties- The common features, the elevation of boiling point, The depression of freezing point, solubility, osmosis, Mixtures of volatile liquid – vapour pressure diagram – The representation of distillation, azeotropes, immiscible liquids.

6) Changes of States –

Chemical reactions, Which way is downhill – The Gibbs function minimum, Exergonic & endergonic reaction, perfect gas equilibria, A recipe for equilibrium constants real gas.

Ref 1 Page-161 to 181, Ref. Page No. 212 to 217, Periods – 07

QUANTUM CHEMISTRY

Historical development of quantum theory principal of quantum mechanics, wave particle duality, uncertainty principles, Schrödinger equation, operators simple system – free particle, Particle in a box, Two dimensional Three dimensional box,

Hydrogen like atoms (no derivation) atomic orbital. **Periods – 10**

Reference Books -

1. Physical Chemistry - P.W. Atkin, ELBS fourth edition.
2. Physical Chemistry – R.A. Alberty, R.I. Bilby, Johy Wiley – 1995
3. Physical Chemistry – G.M. Barrow, Tata Mc – Graw Hill – 1988
4. Quantum Chemistry, - I . Levine, Fifth edition, Prentice Hall- 1999
5. Physical Chemistry – Thomas Engel, Philip Reid.

Section – II

1. CHEMICAL KINETICS

1. Recapitulation:-

Reaction rate, Rate law & rate constants, The determination of rate law, first order reactions, second order reactions, Half life.

Ref 1 Page – 689 to 697. Periods - 02

2. According for rate laws:-

Simple reactions, The temperature dependence of reaction rates, Reaction approaching equilibrium consecutive reactions, The steady state approximations, Pre-equilibira, Unimolecular reactions, Enzyme catalysis – Michaelis Menton mechanism, Lineweaver and Eadie plots, The kinetics of complex reaction, Chain reactions, the structure of chain reactions Explosions, - Fast reactions, flash photolysis, Flow technique, relaxation methods,

Ref. 1 Page -698 to 708, Ref 1 Page – 714 to 716 Ref1 Page – 720 Ref. 1 Page 729 to 732 Period – 12

3. Molecular reaction dynamics:-

Collision theory basic calculation, the steric requirement, Diffusion controlled reactions- Classes of reactions, diffusion & reaction, the details of diffusion, Activated complex. The reaction co – ordinate & transition state, the formulation & decay of the activated complex, How to use the Eyring equation. Thermodynamic aspect, reaction between ions, Dynamics of molecular collisions,

Ref 1 Page – 737 to 758. Period - 06

2. STATISTICAL THERMODYNAMICS

Thermodynamic probability of a system, the moat probable distribution, the partition function, systems of independent particles, the energy of a system, the separation of partition function, The partition function for translation, The thermodynamic functions for translation, monochromic gases, Thermodynamic function for rotation, vibration, & Electronic excitation, Rotation, the electronic portion function, Results of statistical Calculation, statistical calculation of equilibrium constant, entropy & probability, Bose-Einstein & Fermi Dirac Statistics.

Ref . 2 Page – 751 to 772. Periods - 10

Ref 1 Physical chemistry – P.W. Atkins, ELBS Fourth edition.
Ref 2 Principles of Physical chemistry – S.H. Maron & C.F. Pruton fourth edition
Ref. 3 Chemicals Kinetics, K.J. Laidler (Tata Mc. Graw Hill) 1998
Ref . 4 Physical Chemistry, T. Engle and P. Reid, (Pearson Education) 2006
Ref. 5 Basic Chemical Thermodynamics, E. Brian Smith (ELBS) 1990
Ref. 6 Statistical Thermodynamics, L.K. Nash.
Ref.7 Physical Chemistry molecular approach, D.Mcquarie and J. Simom(Viva) 2000.

CH – 210 PHYSICAL CHEMISTRY

Section I : MOLECULAR SPECROSCOPE (30 Lectures)

1. Recapitulation : Width and intensity of spectral transitions, Forier transform, microwave spectroscopy, rotation spectra of di – and poly- atomic molecules, Stark effect. (5)

2. Infra red spectroscopy : Harmonic and an harmonic oscillator, vibrational spectra of di – and poly- atomic molecules, coarse and fine structure, Nuclear spin effect, application, (7)

3. Raman Spectroscopy: Introduction, Rotational Raman spectra, Vibrational Raman Spectra, polarization of light and Raman effect, structure elucidation from combined Raman and IR spectroscopy, applications in structure elucidation. (6)
4. Electronic spectroscopy of molecules: Born – Oppenheimer approximation, electronic spectra of diatomic molecules, vibrational coarse structure, rotational fine structure dissociation energy and dissociation products, electronic structure of diatomic molecules, molecular photoelectron spectroscopy, application. (8)
5. ESR and Mossbaur spectroscopy applications. (2)
6. Principles of NMR – Chemical applications of PMR in structure elucidation. (2)
References:-
i) Fundamentals of molecular spectroscopy : C.N. Banewell and E.Mc. Cash (Fourth edition).
SECTION II : NUCLEAR & RADIATION CHEMISTRY (30)
1) Radio Chemistry : recapitulation – type of radioactive decay, Decay Kinetics, Detection & measurement of radiation (G.M. & Scintillation counter) (03)
2) Elements of radiation chemistry – Radiation chemistry, interaction of radiation with miller, passage of nucleous through matter, interaction of radiation with matter, Units. for measuring radiation absorption, Radiation dosimetry, Radiolsis of water, free radiation in water Radiolsis, Radiolysis of some aqueous solution. (08)
3) Nuclear Reactor :-
The fission energy, The Natural uranium reactor, the four factor formula- The reproduction factor K, the classification of reactor. Reactor power, Critical size of thermal reactor, excess reactivity & control, the Breeder reactor, The Indians nuclear energy programme, Reprocessing of spent fuel : Recovery of Uranium & Plutonium, Nuclear waste management, Natural nuclear reactor. (08)
4) Isotopes for nuclear reactors.
Isotope separation, separation of selected isotopes, Plutonium. (4)
5) Applications of radioactivity :-
Typical reaction involved in preparation of radioisotopes:
$_{3}H$, $_{14}C$, $_{22}Na$, $_{32}P$, $_{35}S$, and $_{137}I$General principles of using radioisotopes.
- Physical constants – Diffusion coefficients, surface area, solubility.
- Analytical applications- neutron activation analysis, dilution analysis, radiometric titration.
- Industrial applications – ratiation guaging, friction and wear out, gamma radiography.
Reference Books.
1. Elements of Nuclear chemistry – H.J. Arnikar, fourth edition wiley Estern Ltd.
2. Source book of atomic energy – S. Glasstanc, D. Van Norton company.
3. Chemical applications of radioisotopes – H.J. M. Brown Buffer & Jammer Ltd.

CH – 107 :- PHYSICAL CHEMISTRY PRACTICALS :

A) Conductometry:
i) Hydrolysis of NH_4Cl or CH_3COON_a or aniline. hydrochloride.
ii) Determination of $\lambda 0$ or $\lambda\alpha$ and dissociation constant of acetic acid.
iii) Hydrolysis of ethylacetate by NaoH.
iv) Determination of ..G, ..H, and .. S of Silver Benzoate by conductometry.
B) Poetentiomerty:-
1. Stability Constant of a complex ion.
2. Solubility of a sparingly soluble salt.
3. To determine the ionic product of H_2O
4. Estimation of halide in mixure.

C) pH metry:-
1. Determination of the acid and base dissociation constant of an amino acid and hence the isoelectric point of the acid.
D) Polarography
1. Determination of half wave potential E 1/2 and unknown concentration of an ion.
2. Amperometric titration of Pb(NO3)2 with $K_2Cr_2O_7$
E) Colorimetric :-
1. Analysis of a binary mixture.
2. Copper EDTA photometric titration.
F) Radioactivity:-
1. Estimation of Mn in tea leaves by NAA
2. Half – life of a radioactive nuclide and Counting errors.
3. Determination of Emax of beta radiation and absorption coefficients in Al.
G) Chemical Kinetics:
1. Kinetic decomposition of diacetone alcohol by dilatometry.
2. Determination of an order of a reaction.
3. Bronsted primary salt effect.
H) Non- Instrumental :-
1) Freundlich and Longmuir isotherms for adsorption of acetic acid on active charcoal
2) Statistical treatment of experiemntal data
3) Molecular weight by steam distillation.
4) Glycerol radius by viscosity.
5) Partial Molar Volume (Polynometry) Determination of the densities of a series of soltions and to calculate the molar volumes of the components. Each candidate should perform a minimum of 18 experiments with at least one experiment form each techniques.
I) Surface area analysis by BET method e.g. industrial pigment

References:-

1. Practical physical chemistry, A. Findary, T.A. kitchner (Longmans, Green and Co.)
2. Experiments in Physical Chemistry, J.M. Wilson, K.J. Newcombe, A.r. Denko. R.M.W. richett (Pergamon Press)
3. Senior Practical Physical Chemistry, B.D. Khosla and V.S. Garg (R. Chand and Co., Delhi.)

(OLD) CH – 130 : INORGANIC CHEMISTRY – I
(New) CH – 130 Symmetry, Stereo & Main group chemistry (60 L)
A. Symmetry & Stereochemistry (30L)
1 Definitions and theorems of group theory, subgroups, Classes (2L)
2
Molecular symmetry and symmetry groups – symmetry elements and operations. Symmetry planes, reflections, inversion centre, proper/ improper axes of rotation, products of symmetry operations, equivalent symmetry elements and atoms, symmetry elements and optical isomerism, symmetry point groups, classes of symmetry operations, classification of molecular point groups. (2L)
3
Representations of groups
Great orthogonality theorem, character tables, properties of characters of representations. (No mathematical part.)
(10L)

4
Group theory and quantum mechanics,. Wave function as basis for irreducible representations.
(2L)
5
Symmetry Adapted Linear Combinations (SALC) – Projection operators and their use of construct SALC
(4L)
6
Molecular Orbital Theory
Transformation properties of atomic orbital, MO's for Sigma bonding AB_n molecules, tetrahedral AB_4 case.
(2L)
7
Crystallographic Symmetry.
Unit cell, screw axis, glide plane on unit cell, crystal lattice, space lattice, stereographic projectors. Examples on crystallographic planes, cubic planes, Miller indices, Bravais lattices.
(6L)
B. Chemistry of Main group Elements (30 L)
1
Hydrogen & its compounds:
Hydrides Classification, e deficient, e precise & e rich hydrides PH_3,SbH_3, AsH_3 , Selenides, Tellurides.
(3L)
2
Alkali & alkaline earth metals
Solutions in non-aqueous Media.
Application of crown ethers in extraction of alkali & alkaline earth metals.
(2L)
3
Organometallic compounds of Li, Mg, Be, Ca, Na
Synthesis , properties, uses & structures.
(3 L)
4
Boron group
Boron Hydrides, preparation, structure & bonding with reference to LUMO, HOMO, interconversion of lower & higher borances, Metalloboranes, Carboranes.
(4L)
5
Carbon group
Allotropes of Carbon, C_{60} and compounds (fullerenes), Intercalation compounds of Graphite, Carbon nanotubes, synthesis, Properties, structure- single walled, Multiwalled, applications, classification of organomentallic compounds.
Organometallic compounds of B, Si, Sn, Pb, Ga,As, Sb, Bi. Structures, Synthesis, Reactions.
(8L)
6
Nitrogen group
Nitrogen activation, Boron nitride, Oxidation states of nitrogen &

their interconversion PN & SN compounds
Nos, & their redox chemistry.
(3L)
7
Oxygen group
Metal selenides & tellurides, oxyacids & oxoanions of S & N.
Ring, Cage and Cluster compounds of P- block elements.
Silicates, including Zeolites
(2L)
8
Halogen group
Interhalogens, Pseudohalogen, synthesis, properties &
applications, structure, oxyacids & oxoanions of Hallogens
Bonding.
(3L)
9
Noble gases
Synthesis, properties, uses, structure & bonding with respect to
VSEPR.
(2L)
Text Books:
1. Chemical application and group Theory: F.A. Cotton, 3rd edition (1999)
2. Advanced Inorganic Chemistry :F.A. Cotton, G. Wilkinson, C.A. Murillo, M.Bochmann 6th Edn. (2003)
Reference Books:
1. Symmetry in Chemistry: H. Jaffe' and M. Orchin (2002)
2. Group theory and its chemical application: P.K. Bhattacharya, 2nd edn. (1989) (Himalaya Publication)
3. Inorganic Chemistry: Shriver and Atkins, 4th edn. (2003) Oxford.

CH – 127 : INORGANIC CHEMISTRY PRACTICALS.

1. Ore Analysis: At least two of the following:-
a. Determination of Silica and Manganese in pyrolusite
b. Determination of Copper and iron from chalcopyrite.
c. Determination of iron from hematite.
2. Alloy Analysis (At least two of the following)
a. Determination of tin & lead from solder.
b. Determination of iron & chromium from mild steel.
c. Determination of copper and nickel from cupronickel.
3. Inorganic Synthesis and Purity determination (any five)
a. Cis/trans potassium di-aquo di-oxalato chromate (III)
b. Chloro penta-ammino cobalt (III) chloride
c. Nitro penta-ammino cobalt (III) chloride
d. Nitrito penta-amino cobalt (III) Chloride.
e. Tris, 2-4 pentanedionato cobalt (III)trihydrate
f. Potassium tri-oxalato aluminate
g. Reinecke's salt.
4. Nickel complexes; Preparation of $[Ni(en)_3]$ S_2O_3, $[Ni(H_2O)_6]$ Cl_2, $[Ni(NH_3)_6]$ Cl_2 and studying their absorption spectra.
5. Ion – exchange chromatography; Separation & estimation of (Zn^{+2}/ Cd^{+2}) & (Zn^{+2} / Mg^{+2}) in mixtures using Amberlite IRA 400 anion exchanger.
6. Instrumental methods of analysis.
a. Colorimetry:
i. Simultaneous determination of Cr. & Mn.

ii. Determination of Keq of M – L systems such as
Fe (III) – Salicylic acid
Fe(III) – Sulphosalicylic acid
Fe(III) – β – resorcilic acid by Job's &Mole ratio method.
iii. Determination of iron by solvent extraction techniques in a mixture of Fe^{+3} +AL^{+3} & Fe^{+3} + Ni^{+3} using 8 - hydroxyquinoline reagent.
b. Conductometry.
Verification of Debye Huckle theory of ionic conductance for strong electrolytes KCl, $BaCl_2$, K_2SO_4, $K_3[Fe(CN)_6]$
c. Table work; (any one)
i. Analysis of Electronic Spectra of transition metal complexes at least for one system [d_n (Oh) or (Td)] and calculation of Crystal Field parameters, interelectronic repulsion parameter and bonding parameter.
ii. Data analysis, error analysis, lest squares method Plot of Born Maeyer to determine for 1 : 1 type molecule to determine inter nuclear separation. Characterization of metal ligand bonding using IR spectroscopy.
7. Synthesis and Characterisation of nano materials : Quantur dots (cds)

Reference Books:

1) Text book of Quantitative Analysis, A.I. Vogel 4th edn (1992)
2) Electronic Spectroscopy by A.B. P. Lever.
3) Inorganic Synthesis (Vol. Series)
4) Practical Manual made By Department of Chemistry, University of Pune.

(OLD) CH – 230: INORGANIC CHEMISTRY – II
(New) CH – 230 : Coordination & Bioinorganic chemistry) (60L)
A. Coordination Chemistry. (30L)
1 Concept & Scope of Ligand Fields (2L)
2
Energy levels of transition metal ions, free ion terms, term wave functions, spin-orbits coupling.
(6L)
3
Effect of ligand field on energy levels of transition metal ions, weak cubic ligand field effect on Russell- Saunders terms, strong field effect, correlation diagrams, Tanabe- Sugano Diagrams, Spin-Pairing energies.
(8L)
4
Electronic spectra of complexes- band intensities, band energies, band width & shapes, spectra of 1st , 2nd & 3rd row ions and rare earth ion complexes, spectrochemical & nephlauxetic series, charge transfer & luminescence, spectra, calculations of Dq, B, β parameters.
(10L)
5
Magnetic properteis of complexes-paramagnetism 1st & 2nd Ordered Zeeman effect, quenching of orbital angular momentum by Ligand fields, Magnetic properties of A, E & T ground terms in complexes, spin free spin paired equilibria
(4L)
B. Bioionrganic chemistry (30L)

6 Overviews of Bioniorganic Chemistry (2L)
7
Principles of Coordination Chemistry related to Bioionorganic –
Protein, Nucleic acids and other metal binding biomolecules.
(9L)
8 Choice, uptake and assembly of metal containing units in Biology (7L)
9 Control and utilization of metal ion concentration in cells. (8L)
10
Binging of metal ions and complexes to bimolecular active
centers.
(4L)

Text Books:

1. Ligand field theory & its applications: B.N. Figgis & M.A. Hitachman (2000) Wiely VCH Publ.
2. Principles of Bioionorganic Chemistry: S.J. Lippard & J.M. Berg (1994), University Science books, Mill Valley, California.

Reference Books:

1. Inorganic Chemistry: Shriver & Atkins (1990) Oxford.
2. Inorganic Electronic spectroscopy: A.B.P. Level, 2nd edn. (1984) Elsevier Science Publishers New York.
3. Biological Chemistry of the Elements: R.J.P. Williams & F.R. Desalvia, Oxford University Press – (1991)
4. Bioinorganic Chemistry : Inorganic elements in the Chemistry of life : An introduction & guide: W. Kaim, B. Schwederski, VCH, 1991 (1991).

CH- 290 : GENERAL CHEMISTRY
DEPARTMENTAL COURSE
ANY TWO PARTS
PART A

Modern Separation Methods & Hyphenated Techniques: (30L)
1
Gas Chromatography: Gas chromatography theory and Instrumentation, Column types, Solid/ Liquid Stationary Phases, Column Switching techniques, Basic and Specialized detectors, elemental detection, chiral separations, pyrolysis gas chromatography, High temperature techniques. Application (Clinical, petrochemical etc.) and problems.
(8L)
2
High performance Liquid Chromatography methods: HPLC theory and instrumentation, Adsorption chromatography, Liquid-Liquid partition techniques, Microbore and capillary chromatography, Affinity techniques, Size exclusion, ion pait separtions, Chiral and Isotope separations, Applications and problems.
(8L)
3 Ion Chromatography (2L)
4
Electrophoresis : Separation by Adsorption- Affinity techniques, Affinity elution from Ion exchangers and other Adsorbents, Pseudo affinity adsorbents polycrylamide gel electrophorsis, Isoelectic focussing Isotachophoresis, Two dimensional gel electrophoreisis, Capillary electrophoresis in rotation- stabilized media,

Electrophoresis in stabilized salts. Applications in Nuclei acids, Clinical and capillary zone electrophoresis of carbohydrates.
(6L)
5
Hyphenated Techniques
Mass spectrometry principle, Instrumentation, Ionization methods – EL, CI, FAB, arc & spark, photoionization, thermal ionization, Fl*& FD, laser induced, Photoelectic ionization, SIMS, Mass analyzers – Magnetic, Double foucusing, Time of flight, Quadrupolar,Ion cyclotron resonance analyzer. Coupled techniques, GC FTIR, GCMS (Use of stable isotopes) HPLC-MS.
(6L)

Text Books:

1. Fundamentals of Analytical Chemistry", D.A. Skoog, D.M. West, F.J. Holler, S.R.Crouch 8th, edn.
2. Instrumental Methods of Analysis H.H. Willard, L.L. Merritt Jr., J.A. Dean, F.A. Settle (CBS Publisher) 7the edn.

Reference Books

1. Practical Aspects of Gas chromatography/ Mass spectrometry. G.M.Message, John wiley & sons, New York, (1984).
2. HPLC: Analytical Chemistry by Open Learning John Wiley & Sons, New York, (1991).
3. Protein Purification: Principles & Practice. Spring International, 3rd Edition, New Delhi, StudentsEdn. (1994).

Part B

Bimolecular: (30L)
1
Cell Structure and function
Prokaryotes & Eukaryotes membrance & cell structure, subcellular components; nucleus, Mitochondria, Endoplasmic reticulum, Golgi apparatus, Lysosomes, peroxisomes.
(4L)
2 Water (2L)
3
Proteins
Introduction, Amino acids, Classification of amino acids, physicochemical properties, reactions with different reagents, Essential & nonessential amino acids. Peptides, end terminal analysis, Primary secondary, tertiary and quaternay structures of Priteins Helix, sheets, super secondary structure, triple helix structures,globular and fibrous proteins.
(8L)
4
Carbohydrates: Introduction, Classification, structures, stereo chemical properties and functions. Derivatives of monosaccarides and their functions.
(5L)
5
Lipids : Classification, functions. Membrane structure, its organization & functions.
(4L)
6
Nucleic acids: DNA & RNA types, structure and function. Super

coiling of DNA Central dogma, physicochemical properties.
(3L)
7 Vitamins: Structure, biochemical functions& deficiency disorders. (4L)

Text Book:

1. Organic Chemistry (5th Edn.) Robert. T.Morrison & N. Boyd. Hill edn.
2. Lehninger's Principles of Biochemistry, (4th edn.), David L. Nelson, Michael M.Cox.

References:

1. Biochemistry (5th edn.) Lubert Stryer.
2. Biochemistry and Physiology of the cell (2nd edn) Edwards and Hassall.

Part – C

Concepts of Analytical Chemistry:

1. Methods of Analytical Chemistry- Introduction, general analytical process, methods of analytical determination. (4L)
2. Error in chemical analysis – Errors & precision, classficiation of errors, determinate errors, determination of accuracy of quantitative analytical methods, accuracy sought. (6L)
3. Accuarcy & precision – The test of statistics precision, averages, study of an analytical procedure, sampling errors, presentation of results. (6L)
4. Principles & Methods of sampilng- Introduction, theory of sampling, pit falls is sampling, technique of sampling gases, liquids and solids, transmission and storage of samples, sources specific sampling information. (8L)
5. Use of Computer programs:

Linear regrression, XY Plots, numerical integration & differentiation, operating with packages such as PCMODEL, WINMOPAC Word processing, Use of MSWORD, Power point & Excel in chemistry, Use of Internet. (6L)

Text Books:

1. Analytical Chemistry :G.D. Christian, Wiley, 6th edn.

Reference Books:

1. Computational Chemistry , G.Grant and W.Richards, Oxford University press.
2. Computer Programming in Fortran 77 and Fortran 90,, V. Rajaraman, Prentice Hall india.

Part D : Chemical Mathematics

Part E – Industrial Methods of Analysis.

Part F Computers for chemists.

Note : Syllabus for above said Part- D, Part- E & Part – F is same as the old syllabus.

CH-150 : ORGANIC CHEMISTRY

(Reaction mechanism and stereochemistry)

1. Nature of Bonding in Organic Molecules. (12 lectures)

A. Delocalized chemical bonding – Conjugation, cross conjugation, resonance, hyper conjugation, tautomerism, inductive Resonance effects.

B. Acidity and Basicity.

C. Introduction to aromaticity in Benzenoid and non – Benzenoid compounds, alternant and non-alternant hydrocarbon, Huckel Rule. Bonds weaker than covalent – addition compounds, Crwon ether complexes and Cryptands inclusion compounds, cyclodextrins, Catenanes, rotaxanes and bonding in Fullerences.

Ref. 5 (Page No. 26 to 74 and 260 to 272.)

2. Stereochemistry (12 Lectures)

Stereo chemical Principlse – Enantiometric relationships, diastereomeric relationships, R and S, E and Z nomenclature, dynamic stereochemistry, parochiral relationship, stereo-specific and stereo selective reactions. Introduction

of optical activity in the absence of chiral carbon (biphenyls, spiranes, allenes and helical structures).
Ref. 5 (Page No. 94 to 115 and 125 to 130).
3. Aliphatic Nucleophilic Substitution (12 Lectures)
The SN2, SN1, mixed SN1 and SN2 and SET mechanism. The neighboring group mechanism, The Neighbouring group participation by π & σ bonds, anchimeric assistance, classical and non classical carbocations, phenonium ions, norbornyl syste, carbocation rearrangements in neighboring group participation. The SNi mechanism. Nucleophile Substitution at an allylic, aliphatic trigonal and vinylic carbon. Reactivity effects of structure, attacking Nucleophile, leaving group and reaction Medium Phase transfer catalyst, ambident nuclephile and regioselectivity.
Ref 5 (Page No. 293 to 369)
4. Addition to Carbon – Carbon Multiple bonds (6 lectures)
Mechanistic and Stereo chemical aspects of addition reactions involving electrophiles,nucleophiles and Free radicals, Regio and Chemo selectivity, Orientation and reactivity, Michael reaction.
Ref. 1 (Page no. 167 – 210.)
5. Aromatic Electrophilic Substitution (8 Lectures)
The arenium ion mechanism, orientation and reactivity, energy profile diagram, The ortho/ para ratio ipso attack, orientation in other ring system,s Naphthalene, Anthracene, Six and five membered heterocycles, Diazonium coupling Vilsmeier reaction, Gattermann – Koch reaction, etc.
Ref. 5 (page no. 501 to 517 and 520 to 545)
6. Aromatice Nucleophilic Substitution (4 Lectures)
the S_NAr, S_N1 Benzyne & S_NR1, Mechanisms, Reactivity effect of substrate structure, leaving group and attacking nucleophile.
Ref . 5 (Page No. 641 to 653)
7. Elimination reactions (6 Lectures) :-
E2, E1, E1cb Mechanisms, Orientation, stereochemistry in elimination, reactivity effect of structre attacking and leaving groups, competition between substitution & elimination , syn eliminations.
Ref. 5 (relevant pages)
CH – 250 : SYNTHETIC ORGANIC CHEMISTRY AND SPECTROSCOPY
1. Oxidation and Reduction (12 Lectures)
CrO_3 (Jones reagent) PDC, PCC, $KMnO_4$, MnO_2 , Swern, SeO_2, Pb (OAc)$_4$, Pd/C, OsO_4, mCPBA, O_3, $NalO_4$, HIO_4 R_3 SiH, Bu_3SnH, Boranes & Hydroboration reactions, MVP, H_2/ catalyst, Wilkinson's catalyst, $NaCNBH_3$, NH_2NH_2, DIBAL, etc.
Ref. 1, 2, 10 (relevant pages)
2. Rearrangements (10 Lectures)
a. Reactive intermediate, Carbocations, carbanions,carbenes, nitrenes
b. Beckmann, Hofmann, Curtius, Schmidt, Wolf, Lossen, Baeyer – Villiger, Sommelet, Favorskii, Pinacole – Pinacolone, Benzil – Benzillic acid, Claisen and Cope Rearrangements, Fries Migration.
Ref 3 (page no. 618 to 660)
3. Phosphorous, Nitrogen and Sulphur Ylids and stereochemistry of compounds containing Phosphrous, Sulfur and Nitrogen (4 Lectures)
Ref. 1, 4 (relevant pages)
4. Addition to Carbon – Hetero Multiple bonds (6 Lectures)
Addition of Grignard Reagent, Organo Zinc, Organo Copper, and Organo lithium reagents to Carbonyl and unsaturated Carbonyl compounds.
Ref. 1 (Page No. 376 -394) and (Page No. 615 to 664)

Ref. 5 (page no. 920 – 936)
5. Conformation of acyclic molecules and shape of six membered rings
(6 Lectures)
Ref. 11 (Page No. 124 to 139 and 204 to 215)
6. Spectroscopy (22 Lectures)
a. U.V. : Electronic transitions, Chromophores, Auxochromes, Bathochromic and hypsochromic shifts, Solvent effects, Wood ward – Fieser Rules for dienes. enones and aromatic compounds Applications of U.V., instrumentation of recording of spectra.
Ref 6, 7 (relevant pages)
b. I.R.: Vibrational Transitions, Important group frequencies, Factors affecting I.R. group frequency, Applications of I.R. Instrumentation and recording of spectra.
REf. 8 (relevant pages)
c. NMR. : Elementary ideas of NMR Integration, Chemical shifts. Factors affecting, Chemical shifts, Coupling (First order, analysis), Instrumentation & recording of spectra.
Ref. 6, 9, 13 (relevant pages)
d. Problems in U.V., I.R. and N.M.R.
Ref. 13

References:

1. Carey and Sundberg. (Ed. III) , Part B – Adv. Organic Chemistry.
2. H.O. House , Synthetic Organic Chemistry.
3. Gould E.S., Mechanis and Structure in Organic Chemistry.
4. Norman R.O.C. Organic Chemistry.
5. J. March,(Ed IV), AdvOrganic Chemistry.
6. Silversteine and Basser, Spectrometric Identification of Organic Compounds.
7. Kalsi, Organic Spectroscopy.
8. J. Bellamy, Infrared spectra of Complex molecules.
9. I Fleming, Organic Spectroscopy.
10. J. Clayden, N.Greeves et. al Organic Chemistry
11. Eliel, Stereochemistry.
12. D. Nashipuri, Stereochemistry of Organic Compounds
13. Pavia Spectroscopy of Organic Compounds
14. Vogel Practical Organic Chemistry.

CH – 247 : ORGANIC CHEMISTRY PRACTICALS
1. Techniques:
Crystallization, fractional crystallization, fractional distillation, vacuum distillation, sublimation, steam distillation, column chromatography, thin layer chromatography (purity would be checked by m.p. and mixed m.p.)
2. Preparation of derivatives.
Oxime, 2,4 – DNP, acetyl, benzoyl, semicarbazide and aryloxyacetic acid, Anilide, Amide.
3. Preparations: Single Stage / Double stage.
Single Stage (Any Four)
i) Cyclohexanone to adipic acid.
ii) Benzaldehyde to dibenzylidene acetone
iii) Benzaldehyde to cinnamic acid
iv) P – aminobenzoic acid to p-chlorobenzoic acid
v) 4 – Chlorobenzalehyde to 4 – Chlorobenzoic acid + -chlorobenzyl alcohol (Canninzzaro reaction)
vi) Benzene to β – benzoyl propionic acid (Friedel Craft reaction)
vii) N, N, Dimethyaniline to 4 – Formyl – N, N – Dimethylaniline.

viii) Benzophenone to Benzpinacol.
4. Double Stage: (Any four)
i) Phthallic anhydride – Phthallimide – Anthranillic acid.
ii) Acetophenone – Oxime – Acetanillide.
iii) Phthalic anhydride – o – benzoyl benzoic acid anthraquinone.
iv) Chlorobenzene – 2, 4 – dinitrochlorobenzene – 2,4-dinitrophenol.
v) Benzoin – Benzil – Benzilic Acid
vi) Acetanilide – p – Bromoacetanilide – p – Bromoaniline.
5. Use of Computer - Chem Draw Chem-Sketch, ISI – Draw:
Draw the structure of simple aliphatic, aromatic, heterocyclic compounds with different subsistent. Get the correct IUPAC name and predict the H_1NMR signals.
Ref. 14 (Relevant pages)

- Pattern of practical examination

Q. 1 Preparation (Single Stage) or Derivative 30 marks
Q. 2. Techniques : Column or TLC or Steam Distillation 30 marks
Q. 3 Assignment on computer 10 marks
Q. 4. Oral 10 Marks.

SYLLABUS AND SAMPLE QUESTIONS

Subject Subject
Code No.
34 Life Sciences
UNIVERSITY OF PUNE
Ganeshkhind, Pune-411007
SET (Life Sciences) / 2
life science_SET syllabus (03-09)

[34] : LIFE SCIENCES

The syllabus consist of two papers as follows :
Paper II and Paper III will be of 75 minutes and 2½ hours duration respectively. Paper II will be of 100 marks and Paper III will be of 200 marks. In Paper III there will be 10 questions each
of Botany, Zoology, Microbiology, Biochemistry and remaining 20 questions are of Genetics, etc.
Students have to attempt any 20 questions.

PAPER II

1. **Cell Biology :** Structure and function of cells and intracellular organelles (of both prokaryotes
and eukaryotes), Mechanism of cell division including (mitosis and meiosis) and cell differentiation; Cell-cell interation, Malignant growth, lmmune response : Dosage compensation
and mechanism of sex determination.
2. **Biochemistry :** Structure of atoms, molecules and chemical bonds, Principles of physical chemistry, Thermodynamics, kinetics, dissociation and association constants, Nucleic acid structure, genetic code, replication, transcription and translation : Structure, function and metabolism of carbohydrates, lipids and proteins, Enzymes and coenzyme, Respiration and photosynthesis.
3. **Physiology :** Response to stress, Active transport across membranes, Plant and animal hormones
Nutrition (including vitamins), Reproduction in plants, microbes, plant and animals, Sensory responses in microbes, plant and animals.
4. **Genetics :** Principles of Mendelian inheritance, chromosome structure and function, Gene Structure and regulation of gene expression, Linkage and genetic mapping, Extra-chromosomal
inheritance (episomes, mitochondria and chloroplasts), Mutation, DNA damage and repair, chromosome aberrations, Transposons, Sex-linked inheritance and genetic disorders, Somatic cell genetics, Genome organisation (in both prokaryotes and eukaryotes).
5. **Evolutionary Biology :** Origin of life (including aspects of prebiotic environment and molecular
evolution), Concepts of evolution, Theories of organic evolution, Mechanisms of speciation, Hardy-Weinberg genetic equilibrium, genetic polymarphism and selection, Origin and evolution
of economically important microbes, plants and animals.
6. **Environmental biology :** Concept and dynamics of ecosystem, components, food chain and
energy flow, productivity and biogeochemical cycles, Types of ecosystems, Population ecology
and biological control, Community structure and organisation, Environmental pollution,

Sustainable development, Economic importance of microbes, plants and animals.
7. **Biodiversity and Taxonomy :** Species concept, Biological nomenclature theories of bilogical
classification, Structural biochemical and molecular systmatics, DNA finger printing, numerical
taxonomy, Biodiveristy, characterization, generation, maintenance and loss, Magnitude and distribution of biodiversity, economic value, wildlife biology, conservation strategies, cryopreservation.

PAPER III

1. Principles of Taxonomy as applied to the systamics and Classification of Plant Kingdom, Taxonomic structure, Biosystematics, Plant geography, Floristics.
2. Patterns of variation in morphology and life history in plants, broad outlines of classification
an evolutionary trends among algae, fungi, bryophytes and pteriophytes, Principles of palaeobotany, Economic importance of algae, fungi and lichens.
3. Comparative anatomy and developmental morphology of gymnosperms and angiosperms, Histochemical and ultrastructural aspects of development, Differentiation and morphogenesis.
4. Androgenesis and gynogenesis, Breeding systems, Pollination biology, structural and functional
aspects of pollen and pistill, Male sterility, Self and inter-specific incompatibility, Fertilization,
Embryo and seed development.
5. **Plants and civilization :** Centres of origin and gene diversity, Botany, utilization, cultivation
and improvement of plants of food, drug, fibre and industrial values, Unexploited plants of potential economic value, Plants as a source of renewable energy, Genetic resources and their conservation.
6. **Water Relations :** Mineral nutrition, Photosynthesis and photorespiration : Nitrogen, Phosphorous and Sulphur metabolism, Stomatal physiology, Source and sink relationship.
7. Physiology and biochemistry of seed dormancy and germination, Hormonal regulation of growth and development, Photoregulation : Growth responses, Physiology of flowering, Senescence.
8. **Principles of plant breeding :** Important conventional methods of breeding self and cross pollinated and vegetatively propagated crops, Non-conventional methods, Polyploidy : Genetic
variability, Plant diseases and defensive mechanism.
9. Principles of taxonomy as applied to the systematics and classification of the animal kingdom,
Classification and interrelationship amongst the major invertebrete phyla, Minor invertebrate phyla, functional anatomy of the non-chordates, Larval forms and their evolutionary significance.
10. Classification and comparative anatomy of protochordates and chordates, Origin, evolution
and distribution of chordate groups : Adaptive radiation.
11. Histology of mammalian organ systems, nutrition, digestion and absorption, Circulation (open
and closed circular, lymphatic systems, blood composition and function), Muscular contration

and electric organs, Excretion and osmoregulation : Nerve conduction and neurotransmitter, major sense organs and receptors, Homeostatis (neural and hormonal), Bioluminiscence, Reproduction.

12. **Gametogenesis in animals :** Molecular events during fertilization, Cleavage patterns and fate
maps, Concepts of determination, competence and induction, totipotency and nuclear transfer experiments, Cell differentiation and differential gene activity. Morphogenetic determinants in
egg cytoplasm, Role of maternal contributions in early embryonic development, Genetic regulation of early embryonic development in Drosophila, Homeotic genes.

13. Feeding, learning, social and sexual behaviour of animals, Parental care, Circadian rhythms,
Mimicry, Migration of fishes and birds, Sociobiology, Physiological adaptation at high altitude.

14. Important human and veterinary parasites (protozoans and helminths), Life cycle and biology
of Plasmodium, Trypanosoma, Ascaris, Wuchereria, Fasciola, Schistosoma and Leishmania, Molecular, cellular and physiological basis of host-parasite interactions.

15. Arthropods and vectors of human diseases (mosquitoes, lice, flies, and ticks), Mode of transmission of pathogens by vectors, Chemical biological and environmental control of anthropod vectors, Biology and control of chief insect pests of agricultural importance, Plant host-insect interaction, insect-pest management, useful insects, Silkworm.

16. The law of DNA constancy and C-value paradox, Numerical and structural changes in chromosomes, Molecular basis of spontaneous and induced mutation and their role in evolution,
Environment mutagenesis and toxictiy testing, Population genetics.

17. Structure of pro and eukaryotic cells, Membrane structure and function, Intracellular compartments, protein sorting, secretory and endocytic pathways, Cytoskeleton, Nucleus, Mitochondria and chloroplasts and their genetic organisation, cell cycle, Structure and organisation of chromatin, polytene and lamphrush chromosomes, Dosage compensation and sex determination and sex-linked inheritance.

18. Interactions between environment and biota, Concept of habitat and ecological niches, Limiting
factors, Energy flow, food chain, food web and trophic levels, Ecological pyramids and recycling,
Biotic community—concept, structure, dominance, fluctuation and succession, N.P.C. and S Cycles in nature.

19. Ecosystem dynamics and management : Stability and complexity of ecosystems, Speciation
and extinction, Environmental impact assessment, Principles of conservation, Conservation strategies, Sustainable development.

20. Physico-chemical properties of water, Kinds of aquatic habitats (fresh water and marine), Distribution of and impact of environmental factors on the aquatic biota, Productivity, mineral
cycles and biodegradation in different aquatic ecosystems, Fish and Fisheries of India with respect to the management of estuarine, coastal water systems and man-made reservoirs, Biology and ecology of reservoirs.

21. Structure, classification, genetics, reproduction and physiology of bacteria and viruses (of bacteria, plants and animals), Mycoplasma protozoa and yeast (a general accounts).

22. Microbial fermentation, Antibotics, organic acids and vitamins, Microbes in decomposition
and recycling processes, Symbiotic and asymbiotic N2 - fixation, Microbiology of water, air, soil and sewage, Microbes as pathological agents in plants, animals and man, General design and applications of a biofermenter, Biofertilizer.
23. **Antigen :** Structure and functions of different clauses of immunoglobulins, Primary and secondary immune response, Lymphocytes and accessory cells, Humoral and cell mediated immunity, MHC, Mechanism of immune response and generation of immunotogical diversity;
Genetic control of immune response, Effector mechanism, Application of immunological techniques.
24. Enzyme kinetics (negative and positive cooperativity), Regulation of enzymatic activity, Active
sites, Coenzymes, Activators and inhibitors, isoenzymes, allosteric enzymes, Ribozyme and abzyme.
25. Van der Waal's electrostatic, hydrogen bonding and hydrophobic interactions, Primary structure
of proteins and nucleic acids, Conformation of proteins and polypeptides (secondary, tertiary, quanternary and domain structure), Reverse turns and Ramachandran plot, Structural polymorphism of DNA, RNA and three-dimensional structure of tRNA, Structure carbohydrates,
polysaccharides, glycoproteins and peptido-glycans, Helix-coil transition, Energy terms in biopolymer conformational calculation.
26. Glycolysis and TCA cycle, Glycogen breakdown and synthesis, Gluconeogenesis, interconversion
of hexoses and pentoses, Amino acid metabolism, Coordinated control of metabolism, Biosynthesis of purines and pyrimidines, Oxidation of lipids, Biosynthesis of fatty acids, Triglycerides, Phospholipids, Sterols.
27. Energy metabolism (concept of free energy), Thermodynamic principles in biology, Energy
rich bonds, Weak interactions, Coupled reactions and oxidative phosphorylations, Group tranfers,
Biological energy tranducers, Bioenergetics.
28. Fine structure of gene, Eukaryotic genome organisation (structure of chromatin, coding and
non-coding sequences, satellite DNA), DNA damage and repair, DNA replication, amplification
and rearrangements.
29. Organization of transcriptional units : Mechanism of transcription of prokaryotes and eukaryotes,
RNA processing (capping, polyadenylation, splicing, introns and exons), Ribonucleoproteins, Structure of mRNA, Genetic code and protein synthesis.
30. Regulation of gene expression in pro-and eukaryotes, Attenuation and antitermination, Operon
concept, DNA methylation, Heterochromatization, Transposition, Regulatory sequences and transcription factors, Environmental regulation of gene expression.
31. Biochemistry and molecular biology of cancer, Oncogenes, Chemical carcinogenesis, Genetic
and metabolic disorders, Harmonal imbalances, Drug metabolism and detoxification, Genetic

load and genetic counselling.

32. Lysogeny and lytic cycle in bacteriophages, Bacterial transformation, Host cell restriction,
Trasduction, Complementation, Molecular recombination, DNA ligases, Topoisomerases, gyrases, Methylases, Nucleases, Restriction endonucleases, Plasmids and bacteriophage based
vectors for cDNA and genomic libraries.
33. Principles and methods of genetic engineering and Gene targeting, Application in agriculture, health
and industry.
34. Cell and tissue culture in plants and animals, Primary culture, Cell line, Cell clones, Callus cultures,
Somaclonal variation, Micropropogation, Somatic embryogenesis, Haploidy, Protoplast fusion and
somatic hybridization, Cybrids, Gene transfer methods in plants and in animals, Transgenic biology,
Allopheny, Artificial seeds, Hybridoma technology.
35. Structure and organisation of membranes, Glyconjugates and proteins in membrane systems, ion
transport/Na/KATPase/Molecular basis of signal transduction in bacteria, plants and animals, Model
membranes, Liposomes.
36. Principles and application of light, phase contrast, fluorescence, scanning and transmission electron
microscopy, Cytophotometry and flow cytometry, fixation and staining.
37. Principles and applications of gel-filtration, ion-exchange and affinity chromatography, Thin layer and
gas chromatography, High pressure liquid chromatography (HPLC), Electrophoresis and electrofocussing, Ultracentrifugation (velocity and buoyant density).
38. Principles and techniques of nucleic acid hybridization and Cot curves, Sequencing of proteins and
nucleic acids, Southern, Northern and South-Western blotting techniques, Polymerase chain reaction,
Methods for measuring nucleic acid and protein interactions.
39. Principles of biophysical methods used for analysis of biopolymer structure, X-ray diffraction,
fluorescence, UV, ORD/CD Visible, NMR and ESR spectroscopy, Hydrodynamic methods, Atomic absorption and plasma emission spectroscopy.
40. Principles and applications of tracer techniques in biology, Radiation dosimetry, Radioactive
isotopes and half life of isotopes, Effect of radiation on biological system, Autoradiography; Cerenkov radiation; Liquid scintillation spectroscopy.
41. Principles and practice of statistical methods in biological research, samples and populations;
Basic statistics—average, statistics of dispersion, coefficient of variation, Standard error, Confidence limits, Probability distributions (biomial, poisson and normal); Tests of statistical significance, Simple correlation of regression, Analysis of variance.
SAMPLE QUESTIONS
PAPER II

1. X chromosome heterochomatinization in mammalian female has been found to involve
(A) cytosine methylation (B) DNA rearrangements
(C) activation of transposable sequences (D) protein deacetylation

2. One of the following is an *ex-situ* method of conservation of plants.
(A) Biosphere reserve (B) Wildlife sanctuary
(C) Protected forest (D) Micropropagation

PAPER III

1. Discuss the following :
(A) Role of phytochrome in plants
(B) Hormonal regulation of senescence of leaves.
2. Give a reaction each involving the transter of Pi and AMP from ATP.
3. State the Hardy Weinberg principle. Give its utility. How can one check a population to find
out if it has reached H-W equilibrium ?
4. Describe in brief the stages in primary succession in an aquatic ecosystem.

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University of Pune
Bioinformatics Centre

Syllabus for Entrance Examination for admission to Ph.D. in Bioinformatics

Paper II

Note: Paper II comprises of two sections. Both the sections carry equal weightage.

Section I: Bioinformatics

 Major Bioinformatics Resources: NCBI, EBI, ExPASy, RCSB

The knowledge of various databases and bioinformatics tools available at these resources, organisation of databases: data contents and formats, purpose and utility in Life Sciences.

 Open access bibliographic resources and literature databases:

Open access bibliographic resources related to Life Sciences viz., PubMed, BioMed Central, Public Library of Sciences (PloS), CiteXplore.

 Sequence databases: Formats, querying & retrieval

- Nucleic acid sequence databases: GenBank, EMBL, DDBJ
- Protein sequence databases: Uniprot-KB: SWISS-PROT, TrEMBL, UniParc
- Repositories for high throughput genomic sequences: EST, STS, GSS, etc.
- Genome Databases at NCBI, EBI, TIGR, SANGER

 Viral Genomes

 Archeal and Bacterial Genomes.

 Eukaryotic genomes with special reference to model organisms (Yeast, Drosophila, *C. elegans*, Rat, Mouse, Human, plants such as *Arabidopsis thaliana*, Rice, etc.)

 Structure Databases:

- PDB, NDB, PubChem, ChemBank

 Derived Databases

Knowledge of the following databases with respect to: basic concept of derived databases, sources of primary data and basic principles of the method for deriving the secondary data, organization of data, contents and formats of database entries, identification of patterns in given sequences and interpretation of the same.

- Sequence: InterPro, Prosite, Pfam, ProDom
- Structure: FSSP, DSSP.

 Extraction of knowledge from resources on Immunology, Plant, animal & infectious diseases: databases & servers published in the NAR Database & Web server Issues and other Bioinformatics journals viz. BMC Bioinformatics etc.

 Sequence Analysis

- Various file formats for bio-molecular sequences: GenBank, FASTA, GCG, MSF etc.
- Basic concepts of sequence similarity, identity and homology, definitions of homologues, orthologues, paralogues and xenologues.
- Scoring matrices: basic concept of a scoring matrix, Matrices for nucleic acid and proteins sequences, PAM and BLOSUM series, principles based on which

these matrices are derived. Detailed method of derivation of the PAM and

BLOSUM matrices.

- **Database Searches:**

 Keyword-based Entrez and SRS

 Sequence-based: BLAST & FASTA

 Use of these methods for sequence analysis including the on-line use of the tools and interpretation of results from various sequence and structural as well as bibliographic databases.

- **Pairwise sequence alignments:** basic concepts of sequence alignment, Needleman & Wunsch, Smith & Waterman algorithms (their implementations) for pairwise alignments, gap penalties, use of pairwise alignments for analysis of Nucleic acid and protein sequences and interpretation of results.
- **Multiple sequence alignments (MSA)**: the need for MSA, basic concepts of various approaches for MSA (e.g. progressive, hierarchical etc.). Algorithm of CLUSTALW and PileUp and their application for sequence analysis (including interpretation of results), concept of dendrogram and its interpretation. Use of HMM-based Algorithm for MSA (e.g. SAM method).
- **Sequence patterns and profiles:** Basic concept and definition of sequence patterns, motifs and profiles, various types of pattern representations viz. consensus, regular expression (Prosite-type) and sequence profiles; profilebased database searches using PSI-BLAST, analysis and interpretation of profile-based searches.

Algorithms for derivation of & searching sequence patterns: MeMe, PHIBLAST, ScanProsite & PRATT.

Algorithms for generation of sequence profiles: Profile Analysis method of Gribskov, HMMer, PSI-BLAST.

- **Taxonomy and phylogeny:** Basic concepts in systematics, taxonomy and phylogeny; molecular evolution; nature of data used in Taxonomy and Phylogeny, Definition and description of phylogenetic trees and various types of trees. Phylogenetic analysis algorithms such as Maximum Parsimony, UPGMA, Transformed Distance, Neighbors-Relation, Neighbor-Joining; Probabilistic models and associated algorithms such as Probabilistic models of evolution and Maximum likelihood algorithm, Bootstrapping methods, use of tools such as Phylip, Mega, PAUP.
- **Protein and nucleic acid properties**: Computation of various parameters using proteomics tools at the ExPASy server, GCG utilities and EMBOSS.
- **Comparative genomics:** Basic concepts and applications, whole genome alignments: understanding significance. Artemis as an example.

 Structural Biology

- **Proteins**: Principles of protein structure; anatomy of proteins – Hierarchical organization of protein structure – Primary, Secondary, Super secondary, Tertiary and Quaternary structure; Hydrophobicity of amino acids, Pacing of protein structure, van der Waals and Solvent accessible surface, Internal coordinates of proteins; Derivation, significance and applications of Ramachandran Map, protein folding.

Identification/assignment of secondary structural elements from the knowledge of 3-D structure of macromolecules using DSSP and STRIDE methods.

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- **DNA and RNA**: types of base pairing – Watson-Crick and Hoogstein; types of double helices A, B, Z and their geometrical as well as structural features; structural and geometrical parameters of each form and their comparison;

various types of interactions of DNA with proteins, small molecules.
RNA secondary and tertiary structures, t-RNA tertiary structure.

- **Carbohydrates:**

The various building blocks (monosaccharides), configurations and conformations of the building blocks; formations of polysaccharides and structural diversity due to the different types of linkages.
Glyco-conjugates: various types of glycolipids and glycoproteins.

- **Structure analysis & validation:**
  - PDB Goodies, Procheck, ProsaII, PDBsum
- **3-D structure visualization and simulation:**
  - Visualization of structures using Rasmol or SPDBV or CHIME or VMD.
  - Basic concepts in molecular modeling: different types of computer representations of molecules. External coordinates and Internal Coordinates
  - Concepts of force fields: representations of atoms and atomic interactions, potential energy representation.
- **Classification and comparison of protein 3D structures**:
  - Purpose of 3-D structure comparison and concepts, Algorithms such as FSSP, CE, VAST and DALI, Fold Classes.
  - Databases of structure-based classification: CATH and SCOP
- **Secondary structure prediction**: Algorithms viz. Chou Fasman, GOR methods; analysis of results and measuring the accuracy of predictions using Q3, Segment overlap, Mathew's correlation coefficient.
  PHD and PSI-PRED methods.
- Structures of oligomeric proteins and study of interaction interfaces
- **Tertiary Structure prediction**: Fundamentals of the methods for 3D structure prediction (sequence similarity/identity of target proteins of known structure, fundamental principles of protein folding etc.) Homology Modeling, fold recognition, threading approaches, and a*b-initio* structure prediction methods.
  Detailed protocols/algorithms for Homology modeling, fold recognition and *ab-initio* approaches
- **Molecular modeling and simulations**
  - Macro-molecular force fields, solvation, long-range forces.
  - Geometry optimization algorithms: Steepest descent, conjugate gradient.
  - Various Simulation Techniques: MD, Monte Carlo, docking strategies etc.
  - Molecular mechanics, conformational searches.
  - Fundamentals of docking small and macromolecules to proteins and nucleic acids.
- **Genomics**
  - Large scale genome sequencing strategies
  - Genome assembly and annotation

  - Genome databases of Plants, animals and pathogens
  - Metagenomics
  - Gene networks: basic concepts, computational model such as Lambda receptor and *lac* operon.
  - Prediction of genes, promoters, splice sites, regulatory regions: basic principles, application of methods to prokaryotic and eukaryotic genomes and interpretation of results.
  - Basic concepts on identification of disease genes, role of Bioinformatics-

OMIM database, reference genome sequence, integrated genomic maps, gene expression profiling; identification of SNPs, SNP database (DbSNP). Role of SNP in Pharmacogenomics, SNP arrays.

- Basic concepts in identification of Drought stress response genes, insect resistant genes, nutrition enhancing genes
- Epigenetics
- DNA microarray: databases and basic tools, Gene Expression Omnibus (GEO), ArrayExpress, SAGE databases.
- DNA microarray: understanding of microarray data, normalizing microarray data, detecting differential gene expression, correlation of gene expression data to biological processes and computational analysis tools (especially clustering approaches).

Comparative genomics:

- Basic concepts and applications, BLAST2, MegaBlast algorithms, PipMaker, AVID, Vista, MUMmer, applications of Suffix tree in comparative genomics, synteny and gene order comparisons.
- Comparative genomics databases: COG, VOG

Functional genomics:

- Application of sequence based and structure-based approaches to assignment of gene functions - e.g. sequence comparison, structure analysis (especially active sites, binding sites) and comparison, pattern identification, etc. Use of various derived databases in function assignment, use of SNPs for identification of genetic traits.
- Gene/Protein function prediction using Machine learning tools viz. Neural network, SVM etc

Proteomics

- Protein arrays: basic principles.
- Computational methods for identification of polypeptides from mass spectrometry
- Protein arrays: bioinformatics-based tools for analysis of proteomics data (Tools available at ExPASy Proteomics server); databases (such as InterPro) and analysis tools.
- Protein-protein interactions: databases such as DIP, PPI server and tools for analysis of protein-protein interactions

Modeling biological systems

- Systems biology – Use of computers in simulation of cellular subsystems
- Metabolic networks, or network of metabolites and enzymes
- Metabolic pathways: databases such as KEGG, EMP

- Study of plant pathways –MetaCyc, AraCyc
- Signal transduction networks
- Gene regulatory networks

Bioinformatics Resources at the species level

- ICTV Database, AVIS, VirGen, Viral genomes at NCBI, VBRC, VBCA, PBRC and Subviral RNA database, Species 2000, TreeBASE etc.

Drug design

- Drug discovery process.
- Role of Bioinformatics in drug design.
- Target identification and validation, lead optimization and validation.

- Structure-based drug design and ligand based drug design.
- Modeling of target-small molecule interactions.

 Vaccine design:

- Reverse vaccinology & immunoinformatics
- Databases in Immunology
- B-cell epitope prediction methods
- T-cell epitope prediction methods
- Resources to study antibodies, antigen-antibody interactions

 Structure Activity Relationship - QSARs and QSPRs, QSAR Methodology, Various Descriptors used in QSARs: Electronic; Topology; Quantum Chemical based Descriptors. Use of Genetic Algorithms, Neural Networks and Principle Components Analysis in the QSAR equations.

Section II: Biological, Physical and Chemical Sciences, Mathematics, Statistics and Information Technology

Biological Sciences

Cell Biology

 Basic aspects of Prokaryotic and Eukaryotic cells (plant and animal cells); membranes and cellular compartments, cell organelles, structure and function.
 Cell motility and shape: cytoskeletal elements, cilia and flagella; motor proteins.
 Cell-cell interactions: Intercellular junctions.
 Photosynthesis, transportation of proteins in cells, transpiration, Electron transport chain.
 Cell cycle and its regulation; events during mitosis and meiosis.
 Vesicular transport and protein traffic in cells.
 Different mechanisms of signal transduction, concepts in signal network, Second messenger, molecules involved in various signaling pathways such as G-protein coupled receptors, protein kinases, calcium binding proteins.

Genetics

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 Mendelian principles of inheritance, sex linked inheritance.
 Concept of linkage, linkage maps and recombination.
 Mutations – molecular, point and chromosomal mutations, hotspots.
 Phenotype and genotype relationships, role of environment, from gene to phenotype, gene interactions. Study of quantitative traits.
 Genetics of populations, genetics and evolution.
 X-linked and autosomal diseases, mitochondrial related disease, QTL methods for diagnostics.
 Extra-chromosomal inheritance.
 Immune response, autoimmune disorders, ELISA method.
 Molecular genetics and genetic disorders.

Immunology

 Immune systems: Innate and adaptive immunity in vertebrates
 Antigen processing and presentation
 Antibodies: Immunoglobulins, Immunoglobulin classes and subclasses, CDR and LDR regions and sequence numbering
 Concepts of generation of diversity and specificity in immune system**;** Immunological

methods.

Molecular Biology

 Prokaryotic genome organization and structure.
 Prokaryotic gene expression, factors involved in gene regulation.
 Operons – positive & negative regulation, Processing of RNA and Proteins - Transport and Stability
 Eukaryotic genome organization and structure, Mechanism of gene expression in Eukaryotes, Basic mechanism of transcription and translation. Initiation, elongation and termination of transcription – template & enzyme properties, Promoter & regulatory sequences. Regulation of translation, Post-translational modifications.
 Mechanisms by which genome undergoes changes, recombination, mutation, inversion, duplication, transposition.
 Methods for studying gene expression and regulatory sequences, large-scale expression analysis, use of microarrays.
 Genetic information transfer, details of regulation in eukaryotes & prokaryotes, horizontal gene transfer.
 Methods for studying variation and polymorphism at genome level, PCR, northern, southern, western blotting, RFLP, Fingerprinting, RAPDs, DNA and protein sequencing methods,.
 Epigenetic mechanisms of inheritance and regulatory RNA molecules (RNA; miRNA, siRNA), antisense RNA and their applications.

Biochemistry

 Carbohydrates and lipids, their importance in cells.
 Proteins: Amino acids and their physicochemical properties, peptide bond and peptides.
 Nucleic acids: nucleosides, nucleotides, RNA and DNA. Denaturation and renaturation of DNA.
 Enzymes: Units of activity, coenzymes and metal cofactors, temperature and pH effects, Michaelis-Menten kinetics, inhibitors and activators, active site.

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 Organization of metabolic systems: enzyme chains, multienzyme complexes, multifunctional enzymes & regulatory enzymes.
 Concept of biochemical regulation, feed back and feed forward systems, biochemical oscillations.
 Enzyme kinetics, Lineweaver-Burk plot, Competitive and non competitive inhibition.
 Molecular mechanisms of interactions of small and large molecules including ions, regulation of protein pathways, mechanism of enzyme action, ribozyme and abzymes.
 Isoenzymes, allosteric enzymes, regulation by covalent modification.
 Carbohydrate metabolism: Glycolysis, gluconeogenesis, glycogenolysis, glycogenesis, TCA cycle and oxidative phosphorylation.
 Pentose phosphate pathway; hormonal control, -oxidation and biosynthesis of fatty acids.
 Transamination and deamination of amino acids, ketogenic and glycogenic amino acids, urea cycle.
 Purine and pyrimidine biosynthesis

Physical and Chemical Sciences

 Particle dynamics, Newton's laws of motion, velocity, acceleration, momentum.
 Pressure, temperature, volume relationship.
 First law of thermodynamics, isothermal process, entropy and second law of thermodynamics, reversible and irreversible processes; Concepts of enthalpy, internal energy and potential energy; Inter-relation between potential energy and force.
 Basics of classical mechanics and quantum mechanics.

 Laws of motion
 Refraction of light, focal length of lens, magnification. Definition of resolution, optical and electron microscope.
 Principles of lasers.
 Luminescence, fluorescence and phosphorescence (basic concepts & applications)
 Biophysical Techniques for determining size and shape of macromolecules – ultra centrifugation, electrophoresis and chromatography. Application of spectroscopy (fluorescence and absorption spectroscopy) and X-ray diffraction for determination of biomolecular secondary and tertiary structure – CD, NMR, X-ray crystallography, mass spectroscopy of biological molecules.
 Concept of pH, pK, chemical equilibrium, Henderson-Hasselbach equation, structure of water, chemical forces, hydrophilic and hydrophobic forces, hybridization states of atoms, electronic structure of molecules, and concept of bonding (chemical bonds, ionic bonds, covalent bonds, hydrogen bond, coordinate bonds).
 Basic principle of chemical kinetics – Zero order and first order kinetics, energy of activation. Reversible & irreversible thermodynamics.

Mathematics

 Functions and Graphs: Functions, Relations, notation and representation. Graphs. Review of basic functions. Functions of several variables.
 2D coordinate geometry: Equation of a line, circle, ellipse, parabola, hyperbola
 3D geometry: Equation of sphere, cone, direction cosines, equation of line.
 Basic trigonometric functions.
 Matrix algebra: Addition, subtraction, multiplication, transpose.

 Numerical integration. Interpolation and approximate methods.
 Vector - addition, subtraction, dot, cross, scalar triple product, divergence and curl.
 System of linear equations. Matrix inverse, eigen value, eigen vector, principal component analysis
 Mathematical modeling and simulation

Statistics

 Introduction to principles of statistical sampling from a population, random sampling
 Frequency distributions and associated statistical measures, Probability distributions – normal and binomial.
 Methods of least squares, chi-square test, systematic and random sampling, accidental and systematic errors, correlation and regression analysis. Poisson and extreme value distributions.
 Multivariate analysis, Hypothesis testing, Markov process.
 Bayesian Statistics

Information Technology

Concepts in Computing

 Overview and functions of a computer system.
 Input and output devices.
 Storage devices: Hard Disk, Diskette, Magnetic Tape, RAID, ZIP devices, Digital Tape, CD-ROM, DVD, etc (capacity and access time).
 Main Circuit Board of a PC: Chips, Ports, Expansion slots, etc.
 Memory: Register, buffer, RAM, ROM, PROM, EPROM, EEPROM (comparison).
 Types of Processing: Batch, Real-Time, Online, Offline.
 History of Computers: Evolution, Generation of computers (I, II, III, IV, V), Classification of computers (mainframes, mini computers, microcomputers, special purpose) –comparison with memory, power, cost, size - then and now.

 Types of modern computing: Workstations, Servers.
 An overview of computer viruses: What is a virus? Virus symptoms, How do they get transmitted? What are the dangers, General Precautions?
 Introduction to operating systems: Operating System concept, Windows 2003/XP, Windows Vista, UNIX/LINUX.
 The Internet and its Resources, World Wide Web (WWW): Associated tools, services, resources and various terminologies.

Introduction to Database Systems

 Concepts of various types of databases
 Data Abstraction
 Data Models.
 Instances & Schemes
 E-R Model:
- Entity and entity sets
- Relations and relationship sets
- E-R diagrams.
- Reducing E-R Diagrams to tables

 Network Data Model: Basic concepts

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 Hierarchical Data Model: Basic Concepts
 Text Databases
 Multimedia Databases - Basic Concepts and Applications
- Indexing and Hashing

 Local Area Networking, network devices, IP address, computational cluster
 Parallel Processing/Computing, Cluster computing, Grid computing, etc.
 Java and Perl Programming
 Introduction to Distributed Database Processing; Understand, appreciate and implement relational database design

SQL and Front End Development

 Select Statements
 Data Definition Statements
 Data Manipulation Statements
 Data Control Statements
 Other Database Objects
- Views
- Sequences
- Synonyms

 Application Development using Visual Basic
 Working with Code and Forms.
 Variables, Procedures and Controlling Program Executor
 Standard Controls.
 Data Access using Data Control
 Connecting to Oracle Database using Visual Basic
 Using Oracle DBMS as backend, SQL skills and basic skill in using VB as a front end

Computer Graphics and Visualisation

 Introduction
 Scientific & Engineering opportunities
 Visualization techniques
- Software
- Hardware

o Color representation – RGB, CMY, gray-scale
 Interactive Graphics
 Interaction devices & techniques
 Geometric Transformations
 Viewing in three dimensions. Stereo-pairs, perspective, depth-cue.
 Rendering
 Standards - CGI, GKS, PHIGS.

Programming Languages

(Any one of the following three programming languages: C, JAVA, Perl)

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Programming in C

 Concepts of flowcharts, algorithm development, pseudo codes etc.
 Computer assignments based on the following topics in 'C' programming: Data types, operators and expressions, Hierarchy of operators, control statements including decision (if, if-else), loops (while, do-while, for), branching (switch, break, continue), functions, arrays (1D, 2D- all matrix operations including inverse of a matrix), strings, Pointers, file handling, data structures etc.

Programming in Object Oriented Languages

JAVA

 An introduction to JAVA programming.
 Object-oriented programming and Java.
 Java Basics.
 Working with objects.
 Arrays, Conditionals and Loops.
 Creating Classes and Applications in Java.
 More about methods.
 Java Applets Basics.
 Graphics, Fonts and Color.
 Simple Animation and Threads.
 Advanced Animation, Images and Sound.
 Managing Simple Events and Interactivity.
 Creating User Interfaces with AWT.
 Modifiers, Access Control and Class Design.
 Packages and Interfaces.
 Exception.
 Multithreading.
 Streams and I/O.
 Using Native Methods and Libraries.
 Java Programming Tools.
 Working with Data Structures and Java.
 Image Filters.

Perl

 What is Perl? Why use Perl in Bioinformatics? History of Perl, Availability, Support, Basic Concepts.
 Scalar Data: What is Scalar Data? Numbers, Strings, Scalar Operators, Scalar Variables, Scalar Operators and Functions.
 Arrays and List Data: What is a List or Array? Literal Representation, Variables, Array Operators and Functions, Scalar and List Context.
 Control Structures: Statement Blocks.
 Hashes: What is a Hash? Hash Variables, Literal Representation of a Hash, Hash Functions, Hash Slices.

 Basic I/O.
 Regular Expressions: Concepts About Regular Expressions, Simple Uses of Regular Expressions, Patterns, Matching Operator, Substitutions, The split and join functions
Syllabus for Ph.D. entrance examination. Subject : Bioinformatics. Paper II.
Date: January 09, 2010
11
 Subroutines: System and User Functions, The local Operator, Variable-length Parameter Lists, Lexical Variables
 Miscellaneous Control Structures.
 Filehandles and File Tests: What Is a Filehandle? Opening and Closing a Filehandle, Using Pathnames and Filenames, die, Using Filehandles, The -x File Tests, The stat Function.
 Formats: What Is a Format? Defining a Format, Invoking a Format.
 Directory Access: Directory Tree, Globbing, Directory Handles, Opening and Closing a Directory Handle, Reading a Directory Handle.
 File and Directory Manipulation.
 Process Management: Using system and exec, Using Backquotes.
 Other Data Transformation: Finding a Substring, Extracting and Replacing a Substring
 Formatting Data: Sorting, Transliteration
 System Information: Getting User and Machine Information, Packing and Unpacking Binary Data, Getting Network Information.
 Database Manipulation: DBM Databases and DBM Hashes, Opening and Closing DBM Hashes, Fixed-Length Random-Access Databases, Variable-Length (Text) Databases, Win32 Database Interfaces.
 CGI Programming: The CGI.pm Module, CGI Program in Context, Simple CGI Programs, Passing Parameters via CGI, Perl and the Web.
 Object oriented perl: Introduction to modules, Creating Objects.
 Bioperl: Introduction, Installation procedures, Architecture, Uses of bioperl

Ph.D. SYLLABUS

Unit—I

Electronic Transport in semiconductor, PN Junction, Diode equation and diode equivalent circuit. Breakdown in diodes. Zener diodes, Tunnel diode, Semiconductor diodes, characteristics and equivalent circuits of BJT, JFET, MOSFET

Unit—II

Rectifiers, Voltage regulated ICs and regulated power supply, Biasing of Bipolar junction transistors and JFET. Single stage amplifiers, Multistage amplifiers. Feedback in amplifiers, oscillators, function generators, multi vibrators, Operational Amplifiers (OPAMP)-characteristics and Applications, Computational Applications, Integrator, Differentiator, Wave-shaping circuits, F to V and V to F converters. Active filters, Schmitt trigger, Phase locked loop.

Unit—III

Logic families, flip-flops, Gates, Boolean algebra and minimization techniques, Multivibrators and clock circuits, Counters-Ring, Ripple, Synchronous, Asynchronous, Up and down shift registers, multiplexers and demultiplexers, Arithmetic circuits, Memories, A/D and D/A converters.

Unit—IV

Architecture of 8051 and 8086, Addressing modes, Software development, Memory and I/O interfacing, interrupts, embedded system design tools.

Unit—V

Various data types in C, Storage classes in C, Decision-making and forming loop in program, Handling character. Arrays in C, Structure and union, User defined function, Pointers in C, Pointer to structures, pointer to functions. Dynamic data structure, file handling.

Unit—VI

Maxwell's equations, Time varying fields, Wave equation and its solution, Rectangular waveguide, Propagation of wave in ionosphere. Poynting vector, Antenna parameters, Half-wave antenna vector, Transmission lines. Characteristic of Impedance matching, Smith chart

Unit—VII

Basic principles of amplitude, frequency and phase modulation, Demodulation, Intermediate frequency and principle of superheterodyne receiver, Spectral analysis and signal transmission through linear systems, Random signals and noise, Noise temperature and noise figure. Basic concepts of information theory, Digital modulation and Demodulation PM, PCM, ASK, FSK, PSK, Time-division Multiplexing, Frequency-Division Multiplexing, Data Communications-Circuits, Codes and Modems;

Unit—VIII

Optical sources-LED, Spontaneous emission, Stimulated emission, Semiconductor Diode LASER, Photodetectors-*p-n* photodiode, PIN photodiode, Phototransistors, Optocouplers, Solar cells, Display devices. Optical Fibres-Light propagation in fibre, Types of fibre, Characteristic parameters, Modes, Fibre splicing, Fibre optic communication system-coupling to and from the fibre, Modulation, Multiplexing and coding, Repeaters, Bandwidth and Rise time budgets.

Unit—IX

Transduces-Resistance, Inductance Capacitance, Peizoelectric, Thermoelectric, Hall effect, Photoelectric, Techogenerators, Measurement of displacement, velocity, acceleration, force, torque, strain, speed and sound temperature, pressure, flow, humidity, thickness, pH, position.

Unit—X

Open-loop and close-loop control system, Error amplifier, on-off controller, Proportional (P), Proportional-Integral (PI). Proportional-Derivative (PD), PID controllers

Ph.D. SYLLABUS

Unit—I

Electronic Transport in semiconductor, PN Junction, Diode equation and diode equivalent circuit. Breakdown in diodes. Zener diodes, Tunnel diode, Semiconductor diodes, characteristics and equivalent circuits of BJT, JFET, MOSFET

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Unit—X

Open-loop and close-loop control system, Error amplifier, on-off controller, Proportional (P), Proportional-Integral (PI). Proportional-Derivative (PD), PID controllers

University of Pune
Syllabus for PhD Entrance Test
Paper II - Botany

1. **Principles of taxonomy** - Systematics and criteria for classification of plants, taxonomic structure, biosystematics, plant geography, floristics.
2. **Classification of plants** - Patterns of variation in morphology and life history in plants. Broad outlines of classification and evolutionary trends among algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms. Principles of palaeobotany.
3. **Biochemistry** – Structure of important polysaccharides in plants. Structure of nucleic acids. Protein structure, Enzymes and enzyme kinetics, regulatory enzymes.
4. **Molecular biology** – Chromatin organization, DNA replication and repair, transcription apparatus, transcriptional and post-transcriptional regulation, protein synthesis, targeting and degradation of proteins.
5. **Cell Biology** – Organization of plant cell wall, cell membrane, chloroplasts and other plastids, vacuoles, cytoskeleton. Perception and transduction of signals by cells. Totipotency, differentiation and death of cells.
6. **Genetics** – Principles of Mendelian genetics, linkage and recombination, genetic mapping. Variation in chromosome structure and number, inheritance of quantitative traits, gene frequencies in populations.
7. **Plant Physiology** – Water relations and membrane transport. Photosynthesis and respiration, nitrogen metabolism. Hormones.
8. **Vegetative development** – Organization and activity of shoot and root apical meristems, structure of stomatal apparatus. Structure and activity of cambium, wood structure and variations.
9. **Reproductive development** – Microsporogenesis and megasporogenesis, development of male and female gametophyte, fertilization and embryo development.
10. **Developmental regulation** – Role of hormones and light in regulation of seed germination and flowering. Patterning genes and their role in vegetative development and flowering.
11. **Plant Breeding** – Selection and production of pure lines, hybridization and hybrid breeding, mutation breeding. Conventional methods of breeding self-, cross-pollinated crops and vegetatively propagated crops.
12. **Plant-organism interactions** – Plant pathogens, pests, symbionts and their interactions with host plants. Plant defence mechanisms.
13. **Plant genetic engineering** – Agrobacterium – based vectors, transformation methods (including direct DNA transfer) and characterization of transformants, commercially available transformants. Polymerase chain reaction (PCR) and its applications.
14. **Plant resources and natural products** – Timber, fiber, food and spice yielding plants. Secondary metabolite pathways and phytochemicals used in aroma, flavor and medicine.

15. **Ecology** – Ecosystem: Structures, functions and types, ecological succession, ecological habitat and niche, concept of ecotone. Biomes – basis of classification, plant and animal communities associates with biomes.
16. **Environmental biology** - Pollution ecology, indicator organisms, restoration ecology with reference to plants and microbes. Environmental Impact Assessment and its role in sustainable development. National and International conventions and laws for protection and conservation of biological resources.

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University Of Pune

Department of Environmental Sciences

Ph. D. Entrance Exam

Subject: Environmental Sciences

Eligibility: Master's degree in any discipline of science, Engineering and medical faculty

The Subject test will carry total 100 Marks and the time allotted for completeion of the paper is 2 Hr. The Entrance Examination for Ph.D.in Environmental Sciences is to be held on 14th Feb 2009.

The Exam will be conducted in two sessions. Time allotted for each session is as follows:

Sessions	Type of Question	Time
Session I	Objective Questions	15 Minutes
Sessions II	Short Answer Questions	50 Minutes
	Long Answer Questions	55 Minutes

Distribution of Marks is as follows:

Type of Questions	Marks	No. Of Questions
Objective Questions	20 Marks	10
Short answer questions	40 Marks	08
Long answer Questions	40 Marks	02

The Objective type of Questions will be based on Logic, mathematics, Statistics and General Knowledge.

The Short Answer and Long Answer Questions will be set from the following syllabus:

1) Introduction: Man – Environment Relationship; Anthropogenic factors causing Environmental Degradation.

2) Recent Trends in Environmental Sciences related to Biodiversity, Ecotoxicology, Biodegradation/ Bioremediation, Mathematical Modeling and Computer based simulation for different types of pollutions.

3) Research Methodology: Statement of problem, hypothesis building objectives of the study, Methodological issues, Generation of the data, Application of statistical methods, computer techniques, GIS and RS in analysis of the data.

4) Pollution: Causes, Effects and Remedial Measures of Air, water, Soil, Noise Radiation and Thermal Pollution.

5) Waste Generation and Management: Industrial and domestic; Issues related to urban waste management: Landfilling, composting, social issues, Remedial measures, Handling and management of biomedical and Hazardous waste.

6) Environmental Management System: ISO 14001, Life cycle Analysis, Environmental Auditing: Voluntary and statutory audit. Environmental Accounting; Environmental Impact Assessment, Conflict management, Environmental planning, Carbon footprint Appraisal.

7) Sustainable Development: Philosophy and practices of Sustainable development; Sustainability Index, Components of sustainable development- Economic and social; Current issues related to sustainable development at Global and National level.

8) Environmental Reporting: Global Reporting Initiative, Clean Technology Reporting Initiative, Environmental Status Report of India: ESR of cities and rivers in India.

9) International Conventions, protocol and policies: Stockholm Declaration, Nairobi Declaration, Rio conference, Johannesburg conference, Quoto protocol, carbon trading, Importance of Copenhagen conference.

10) Current Issues and Recent development in the subject.

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University of Pune
Ph.D. Entrance Examination
SYLLABUS: GEOLOGY

Part A]: The objective type questions will be framed on the following syllabus

1. **About the Earth :** The earth and the solar system; important physical parameters and properties of the planet earth; abundance of elements in the earth; primary differentiation of the earth and composition of its various zones; composition of meteorites and the solar photosphere; shape and internal structure of the earth. Uniformitarianism; geological time scale; use of fossils and nuclear clocks in the subdivision of geological time.

2. **Materials of the Earth:** Gross composition and physical properties of important rocks and minerals; properties and process responsible for mineral concentrations; nature and distribution of rocks and minerals in different units of the earth; deformations of rocks; folds and faults and their surface expressions.

3. **Surface Features and Processes:** Physiography of the earth; landscape and seafloor; weathering, erosion, transportation and deposition of earth's material; formation of soil, sediments and sedimentary rocks; energy balance of the earth's surface processes.

4. **Internal Features and Processes :** Elastic waves and fine structure of the earth; crust, mantle and core; thermal, gravitational and magnetic fields of the earth; origin of the main geomagnetic field; mantle convection and plate tectonics; earthquakes and volcanoes; Isostasy.

5. **The Hydrosphere :** The hydrological cycle; inter-relationship of surface and ground water; seafloor spreading and hydrothermal vents; marine sediments, their composition and uses; distribution of temperature and salinity in the ocean; surface circulation, causes of ocean currents and important current systems; deep circulation. Water masses-their formation and characteristics; convergence and upwelling of ocean waters; sea level changes; waves and tides; chemistry of sea water, biological controls on the composition of the oceans; oceanic modulation of climatic changes estuary, bay and marine pollution.

6. **Geology of India:** Land, biotic and mineral resources and their role in development; salient aspects of plant zoogeography; geologic setting; location and approximate reserves of minerals, fuel and water resources of the Indian Territory. Important geological features of the Precambrian shield, the Gondwanas, the Deccan Trap.

7. **Man and Environment :** Ecology, ecosystem and biotic communities; carbon and nutrient cycling and food-chain; human impact on air, land, soil, water, climate and forest resources; conservation of resources; coping with natural hazards; problems of pollution and waste; application of engineering geology to development without destruction; optimum use of energy alternatives.

Part B]: The descriptive type questions will be framed on the following syllabus

(i) **Geomorphology:** Landforms-their types and development; weathering, transport and erosion; landforms in relation to rock type, structure and tectonics. Soils-their development and types. Geomorphic processes and their impact on various landforms and associated dynamics-slope, channel, coastline, glacial and aeolian; evolution of major geomorphological features of the Indian sub-continent; geomorphometric analysis and modelling.

(ii) **Sedimentology:** Classification of sedimentary rocks; petrography of rocks of clastic, chemical and biochemical origin. Sedimentary textures and structures. Diagenesis; marine, non-marine and mixed depositional environments. Facies association, sedimentation and tectonics; basin analysis; Reconstruction of palaeoenvironments using radioactive and stable isotopes.

(iii) **Paleontology:** Origin and evolution of life; fossils and their uses; species concept; functional morphology, classification and evolution of important invertebrate, vertebrate and plant fossils; biomineralisation and trace fossils; types of microfossils and their applications; palaeobiogeography and palaeoecology; evolution of man. Oxygen and carbon isotopic studies on fossils; analysis of palaentological record for tracing plate tectonics processes.

(iv) **Stratigraphy:** Recent developments in stratigraphic classification: Litho bio and chrono stratigraphic units and their interrelationships; modern methods of stratigraphic correlation; steps in stratigraphic studies; approaches to palaeogeography; Earth's climatic history. Rocks of Phanerozoic Eon in India-their intercontinental correlation with special reference to type localities; boundary problems in stratigraphy; geodynamic evolution of the Indian subcontinent through the Phanerozoic.

(v) **Structural Geology and Geotectonics:** Concepts of stress and strain; strain analysis using deformed objects; geometric classification of folds; mechanics of folding; folding in shear zones; geometry of superposed folding; structural analysis in terrains with multiple deformation; foliation and lineation; geometry and mechanics of shear zones; brittle ductile and ductile structures in shear zones; geometry of thrust sheets. Classification of unconformities; map patterns and their uses in the determination of large-scale structures. Isostasy; seismicity; sea-floor spreading and plate tectonics; orogenesis; orogenic belts of India; evolution of the Himalaya and Himalayan tectonics.

(vi) **Mineralogy:** Concept of symmetry, point group lattice and space group; principles of crystal chemistry; principles of optical and X-ray mineralogy. Structural classification of minerals; structure and its interrelation with physical and chemical properties of minerals important phase diagrams of major rock forming minerals and ore minerals; principles of geothermo-barometry.

(vii) **Geochemistry :** Abundances of elements; structure and atomic properties of elements; the Periodic Table; geochemical classification and distribution of elements in the earth; principles of geochemical cycling; principles of ionic substitution in minerals; laws of thermodynamics; concepts of free energy, activity, fugacity and equilibrium constant; thermodynamics of ideal, nonideal and dilute solutions; element partitioning in mineral/rocks formation and concept of distribution coefficients; concept of P-T-X. Eh-pH diagrams and mineral stabilities; radioactive decay schemes, growth of daughter isotopes and radiometric

dating; stable isotopes and their fractionation. Mineral/Mineral assemblages as 'sensors' of ambient environments.

(viii) **Petrology** : Phase equilibria studies of single, binary, temary and quaternary silicate systems with reference to petrogenesis; magmas, their generation in the crust and mantle, their emplacement and their relation to plate tectonics; magmatic crystallization, differentiation and assimilation; classification of igneous rocks; major and trace elements and isotopic composition of igneous rocks in the context of petrogenesis; petrogenesis of important types of igneous rocks; volatile components in petrogenesis. Physical and rheological properties of silicate melts-Bingham liquid; partial melting and fractional crystallization in closed and open system models. Role of T.P. and fluids in metamorphism; metamorphic facies; mineral assemblages and important reactions in different facies; types of metamorphism and metamorphic-belts; relationship among metamorphism, anatexis and grantization. Petrogenetic aspects of important rocks of India such as the Deccan Trap. The Layered intrusions, charnockites, khondalities and 'gondites'.

(ix) **Ore Geology:** Physico-chemical controls of deposition and of post-depositional changes in ores; geological processes of formation of economic mineral deposits; global metallogeny as related to crustal evolution; metallogenesis in space and time. Elements of ore petrology; mineral assemblages and fluid inclusions as 'sensors' of ore-forming environments; Live ore-forming systems. Geological setting, characteristics features and genesis of ferrous and non-ferrous ore deposits of India. Metallogenic history of India.

(x) **Marine Geology:** Morphological and tectonic domains of the ocean floor; midocean ridge systems; seawater-basalt interaction and hydrothermal vents; models and rates of ocean circulation and of sedimentation in the oceans; digenetic changes in oxic and anoxic environments; mobility of redox metals; major components of marine sediments and processes regulating sediment composition; geochronology of marine sediments from radioactivity measurements; sedimentary markers of palaeoenvironmental conditions; mineral resources of the oceans and factors controlling their distribution. Ocean margins; nature of deep sea sediments, their chronology and correlation; tectonic history of the oceans.

(xi) **Petroleum and Coal Geology:** Origin, migration and entrapment of petroleum; properties of source and reservoir rocks; structural, stratigraphic and combinations traps. Techniques of exploration. Petroliferous basins of India. Origin of peat, lignite, bitumen and anthracite. Classification, rank and grading of coal; coal petrography, coal measures of India.

(xii) **Precambrian Geology and Crustal Evolution:** Evolution of the early crust, early Precambrian life, lithological, geochemical and stratigraphic characteristics of granite greenstone and granulite belts. Stratigraphy and geochronology of the Precambrian terrains of India.

(xiii) **Applied Geology:**

(a) **Photo geology and Remote Sensing:** Elements of photogrammetry; elements of photo interpretation; electromagnetic spectrum emission range, film and imagery; multispexctral sensors; geological interpretation of air-photos and imagery.

(b) **Engineering Geology:** Mechanical properties of rocks; geological investigations for the construction of dams, bridges, highways and tunnels.

(c) **Mineral Exploration:** Geological and geophysical methods of surface and subsurface exploration on different scales, sampling, assaying and evaluation of mineral deposits; geochemical and Geobotanical surveys in exploration.

(d) **Hydrogeology:** Ground water, Darcy's law; hydrological characteristics of aquifers; hydrological cycle; precipitation, evapotranspiration and infiltration processes; hydrological classification of water-bearing formations; fresh and salt water relationship in coastal and inland areas; ground water exploration and management, water pollution, ground water regimes in India.

Recognized guides for Ph.D in Geology

Name of the Guide	Numbers of students registered for PhD	Number of vacancies
Prof. N. J. Pawar	**06**	**02**
Prof.N.R.Karmalkar	**06**	**02**
Prof.S.J.Sangode	**02**	**06**
Dr.D.C.Meshram	**02**	**06**
Dr.M.G.Kale	**02**	**06**
Dr.B.N.Umarikar	**02**	**06**
Dr.M.A.Herlekar	**Nil**	**08**
Dr.Aditi.Mookharjee	**Nil**	**08**

UNIVERSITY OF PUNE
Ph.D. Entrance Examination
Subject: Mathematics

This paper shall be of 2 hours duration and shall have a maximum of 100 marks.
The paper will consist of 2 parts. Part A will carry 20 marks and Part B will carry 80 marks.
Part A of the paper shall contain **10** objective type questions, each of **2** marks.
There will not be negative marking for the wrong answers.
Part B of the paper shall have 12 questions out of which a candidate shall be required to answer a maximum of **8** questions. If more than 8 questions are answered from part B only first 8 answered questions will be taken up for evaluation. Each question in Part B carries **10** marks. Use of calculators is allowed.

Syllabus:

UNIT – 1

Analysis: Elementary set theory, finite, countable and uncountable sets, Real number system as a complete ordered field, Archimedean property, supremum, infimum.
Sequences and series, convergence, limsup, liminf. Bolzano Weierstrass theorem, Heine Borel theorem. Continuity, uniform continuity, differentiability, mean value theorem.
Sequences and series of functions, uniform convergence. Riemann sums and Riemann integral, Improper Integrals. Monotonic functions, Lebesgue measure, Lebesgue integral.
Functions of several variables, directional derivative, partial derivative, derivative as a linear transformation. Metric spaces, compactness, connectedness. Normed Linear Spaces. Spaces of Continuous functions as examples.

Complex Analysis: Algebra of complex numbers, the complex plane, polynomials, Power series, transcendental functions such as exponential, trigonometric and hyperbolic functions.
Analytic functions, Cauchy-Riemann equations. Contour integral, Cauchy's theorem, Cauchy's integral formula, Liouville's theorem, Maximum modulus principle, Schwarz lemma, Open mapping theorem. Taylor series, Laurent series, calculus of residues.
Mobius transformations.

NIT – 2

Linear Algebra: Vector spaces, subspaces, linear dependence, basis, dimension, algebra of linear transformations. Algebra of matrices, rank and determinant of matrices, linear equations. Eigenvalues and eigenvectors, Cayley-Hamilton theorem. Matrix representation of linear transformations. Change of basis, canonical forms, diagonal forms, triangular forms, Jordan forms. Inner product spaces, orthonormal basis.

Algebra: Permutations, combinations, pigeon-hole principle, inclusion-exclusion principle, derangements. Fundamental theorem of arithmetic, divisibility in Z, congruences, Chinese Remainder Theorem, Euler's Ø- function, primitive roots. Groups, subgroups, normal subgroups, quotient groups, homomorphisms, cyclic groups, permutation groups, Cayley's theorem, class equations, Sylow theorems. Rings, ideals, prime and maximal ideals, quotient rings, unique factorization domain, principal ideal domain, Euclidean domain.

Polynomial rings and irreducibility criteria. Fields, finite fields.

UNIT – 3

Differential Equations:

Existence and Uniqueness of solutions of initial value problems for first order ordinary differential equations, singular solutions of first order ODEs, system of first order ODEs. General theory of homogenous and non-homogeneous linear ODEs, variation of parameters, Series solution. First and second order partial differential equations.

Lagrange and Charpit methods for solving first order PDEs, Cauchy problem for first order PDEs. Classification of second order PDEs, General solution of higher order PDEs with constant coefficients, Method of separation of variables for Laplace, Heat and Wave equations.

Numerical Analysis :

Numerical solutions of algebraic equations, Method of iteration and Newton-Raphson method, Rate of convergence, Solution of systems of linear algebraic equations using Gauss elimination and Gauss-Seidel methods, Finite differences, Lagrange interpolation, Numerical differentiation and integration, Numerical solutions of ODEs using Picard, Euler and Runge-Kutta methods.

Sample Questions:

Part A

1. Which of the following groups is cyclic ?

A. The permutation group S_3.

B. The group of 2x2 invertible matrices with real entries.

C. The group of integers {0, 1, 2, …, m-1} with addition modulo m.

D. The group of nonzero complex numbers with multiplication.

2. Which of the following functions from R→ R is bounded?

A. $f(x) = (\sin x)/(2 + \cos x)$

B. $f(x) = x + 1$

C. $f(x) = \cosh(x)$

D. $f(x) = \exp(-x)$

Part B

1. Give an example of a UFD which is not a PID. Justify your answer.

2. Using Lagrange Interpolation Method find a polynomial f(x) of smallest degree such that f(0)=2, f(2)= -1, f(3)= 4, f(4)=3.

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Ph.D ENTRANCE TEST
UNIVERSITY OF PUNE
SYLLABUS FOR PHYSICS – (PAPER – II)

1) **Mathematical Methods of Physics –**

Dimensional analysis; Vector algebra and vector calculus; Linear algebra, matrices, 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; Introduction group theory, SU(2), O(3); Elements of computational techniques: roots of functions, interpolation, extrapolation, integration by trapezoid and Simpson's rule, Elementary probability theory, random variables, binomial, Poisson and normal distributions.

2) **Classical Mecanics –**

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 principles, 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.

3) **Electromagnetic Theory –**

Electrostatics : Gauss' Las 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.

4) **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; Schroedinger 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.

5) **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-aid 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.

6) **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.

7) **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.

8) **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 and diatomic molecules; Frank – Condon principle and selection rules; Spontaneous and stimulated emission, Einstein A & B coefficients; Laser, optical pumping, population inversion, rate equation; Modes of resonators and coherence length.

9) **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;.

10) **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 of 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.

Ph.D ENTRANCE TEST
UNIVERSITY OF PUNE
SYLLABUS FOR ZOOLOGY – (PAPER – II)

The syllabus for the subject based paper of 100 marks. Out of 100 marks objective questions of 20 marks and descriptive answer questions of 80 marks would be asked based on the syllabus given below. Duration of paper would be one hour.

Cell Biology : Structure and function of cells and intracellular organelles (of both prokaryotes and eukaryotes), Mechanism of cell division (mitosis and meiosis) and cell differentiation; Cell-cell interaction, Malignant growth, Immune cells,
Structure of prokaryotic and eukaryotic cell, Membrane structure and function, Intracellular compartments, protein sorting, secretory and endocytic pathways, Cytoskeleton, Nucleus, Mitochondria and chloroplasts and their genetic organisation, cell cycle, Structure and organisation of chromatin, polytene and lamphrush chromosomes,
Biochemistry and molecular biology of cancer, Oncogenes, Chemical carcinogenesis

Biochemistry : Structure of atoms, molecules and chemical bonds, Principles of physical chemistry, Thermodynamics, kinetics, dissociation and association constants, Van der Waal's electrostatic, hydrogen bonding and hydrophobic interactions,
Structure, function and metabolism of carbohydrates, lipids and proteins, Enzymes and coenzyme, Respiration and photosynthesis, Enzyme kinetics (negative and positive cooperativity), Regulation of enzymatic activity, Active sites, Coenzymes, Activators and inhibitors, Isoenzymes, Allosteric enzymes, Ribozyme and Abzyme.

Metabolism: Glycolysis and TCA cycle, Glycogen breakdown and synthesis, Gluconeogenesis, interconversion of hexoses and pentoses, Amino acid metabolism, Coordinated control of metabolism, Biosynthesis of purines and pyrimidines, Oxidation of lipids, Biosynthesis of fatty acids, Triglycerides, Phospholipids, Sterols.
Energy metabolism (concept of free energy), Thermodynamic principles in biology, Energy rich bonds, Weak interactions, Coupled reactions and oxidative phosphorylations, Group transfers, Biological energy transducers, Bioenergetics.

Physiology : Response to stress, Active transport across membranes, hormones,
Nutrition (including vitamins), Circulation, Physiology of reproduction, Sensory responses in animals, Neurophysiology and neuroendocrinology.

Genetics : Principles of Mendelian inheritance, chromosome structure and function, Gene Structure and regulation of gene expression, Linkage and genetic mapping, Extra-chromosomal inheritance (episomes, mitochondria and chloroplasts), Mutation, DNA damage and repair, chromosome aberrations, Transposons, Sex-linked inheritance and genetic disorders, Somatic cell genetics, Genome organisation (in both prokaryotes and eukaryotes).
Genetic and metabolic disorders, Hormonal imbalances, Drug metabolism and detoxification, Genetic load and genetic counseling.

Molecular Biology: The law of DNA constancy and C-value paradox, Numerical and structural changes in chromosomes, genome organization, organisation of chromatin,

polytene and lamphrush chromosomes, Mitochondria and chloroplasts and their genetic organization.
Fine structure of gene, Eukaryotic genome organisation (structure of chromatin, coding and non-coding sequences, satellite DNA), DNA damage and repair, DNA replication, amplification and rearrangements.
Organization of transcriptional units: Mechanism of transcription of prokaryotes and eukaryotes, RNA processing , Ribonucleoproteins, Structure of mRNA, Genetic code and protein synthesis.
Regulation of gene expression in pro-and eukaryotes, Attenuation and antitermination, Operon concept, DNA methylation, Heterochromatization, Transposition, Regulatory sequences and transcription factors, Environmental regulation of gene expression.
Genomics, Proteomics.

Recombinant DNA technology: Principles and methods of genetic engineering and Gene targeting, DNA ligases, Topoisomerases, Gyrases, Methylases, Nucleases, Restriction endonucleases, Plasmids and bacteriophage based vectors for cDNA and genomic libraries. Applications of recombinant DNA technology in agriculture, health, pharmaceutical and other industry. Cell and tissue culture in plants and animals, Primary culture, Cell line, Cell clones, Callus cultures, Transgenic biology.

Evolutionary Biology : Origin of life (including aspects of prebiotic environment and molecular evolution), Concepts of evolution, Theories of organic evolution, Mechanisms of speciation, Hardy-Weinberg genetic equilibrium, genetic polymarphism and selection, Origin and evolution of economically important microbes, plants and animals.

Environmental biology : Concept and dynamics of ecosystem, components, food chain and energy flow, productivity and biogeochemical cycles, Types of ecosystems, Population ecology and biological control, Community structure and organisation, Environmental pollution, Sustainable development, Economic importance of microbes, plants and animals.

Biodiversity and Taxonomy : Species concept, Biological nomenclature theories of biological classification, Structural biochemical and molecular systematics, DNA finger printing, numerical taxonomy, Biodiveristy, characterization, generation, maintenance and loss, Magnitude and distribution of biodiversity, economic value, wildlife biology, conservation strategies

Developmental Biology: Gametogenesis in animals **,** Molecular events during fertilization, Cleavage patterns and fatemaps, Concepts of determination, competence and induction, totipotency and nuclear transfer experiments, Cell differentiation and differential gene activity. Morphogenetic determinants in egg cytoplasm, Role of maternal contributions in early embryonic development, Genetic regulation of early embryonic development in Drosophila, Homeotic genes.

Animal behaviour: Feeding, learning, social and sexual behaviour of animals, Parental care, Circadian rhythms, Mimicry, Migration of fishes and birds, Sociobiology,

Parasitology: Important human and veterinary parasites (protozoans and helminths), Life cycle and biology of Plasmodium, Trypanosoma, Ascaris, Wuchereria, Fasciola, Schistosoma and Leishmania, Molecular, cellular and physiological basis of host-parasite interactions.

Entomology: Arthropods and vectors of human diseases (mosquitoes, lice, flies, and ticks), Mode of transmission of pathogens by vectors, Chemical biological and environmental control of arthropod vectors, Biology and control of chief insect pests of agricultural importance, Plant host-insect interaction, insect-pest management, useful insects, Silkworm.

Immunology: Antigens, Structure and functions of different clauses of immunoglobulins, Primary and secondary immune response, Lymphocytes and accessory cells, Humoral and cell mediated immunity, MHC, Mechanism of immune response and generation of immunological diversity; Genetic control of immune response, Effector mechanism, Application of immunological techniques.

Tools and techniques:

Principles and application of light, phase contrast, fluorescence, scanning and transmission electron microscopy, Cytophotometry and flow cytometry, Principles of histology and histochemistry.

Principles and applications of gel-filtration, ion-exchange and affinity chromatography, Thin layer and gas chromatography, High pressure liquid chromatography (HPLC), Electrophoresis and electrofocusing, Ultracentrifugation (velocity and buoyant density).
38. Principles and techniques of nucleic acid hybridization and Cot curves, Sequencing of proteins and nucleic acids, Southern, Northern and South-Western blotting techniques, Polymerase chain reaction, Methods for measuring nucleic acid and protein interactions.

Principles of biophysical methods used for analysis of biopolymer structure, X-ray diffraction, fluorescence, UV, ORD/CD Visible, NMR and ESR spectroscopy, Hydrodynamic methods, Atomic absorption and plasma emission spectroscopy.

Principles and applications of tracer techniques in biology, Radiation dosimetry, Radioactive isotopes and half life of isotopes, Effect of radiation on biological system, Autoradiography, Cerenkov radiation, Liquid scintillation spectroscopy.

Principles and practice of statistical methods in biological research, samples and populations; Basic statistics—average, statistics of dispersion, coefficient of variation, Standard error, Confidence limits, Probability distributions (binomial, Poisson and normal); Tests of statistical significance, Simple correlation of regression, Analysis of variance.

Department of Atmospheric and Space Sciences
Syllabus (Paper II) for Ph. D. Entrance Examination

Atmosphere and its constituents, Synoptic observations, Diurnal variation of: temperature, pressure, relative humidity and clouds. Synoptic systems in different seasons: Western disturbance, Rossby Waves, Westerly Jet Stream. Fog, Cold Wave. Thunderstorms, Dust storms, Heat wave, Cyclonic disturbances. Monsoon - Onset, Activity, Withdrawal, Breaks, Depressions, Post-Monsoon Cyclones in the Indian Seas, N.E. Monsoon.

Structure and composition of the atmosphere, Equation of state for dry and moist air, Adiabatic and Isothermal Processes, Humidity Parameters, Virtual Temperature, Standard Atmosphere, Laws of thermodynamics, Entropy, Potential Temperature, Pseudo-adiabatic Process, Equivalent Temperature, Equivalent Potential Temperature, Claussius – Clapeyron Equation, Stability and Instability, Parcel Method, Cloud entraiment, Thermodynamic Diagrams. Growth of cloud droplets by collision and coalescence, Bergeron process

Laws of radiation, long-wave and short-wave radiation, Raleigh and Mie scattering, Absorption spectra of atmospheric gases, Radiative Transfer in the Atmosphere.

Kepler's laws, Polar orbiting and Geostationary satellites.

Vectors, Matrices, Partial Differential Equations, Numerical solution of Partial Differential Equations, Numerical Integration schemes, Fourier series, Finite Differences, Methods of obtaining eigen values, eigen vectors.

Scales of atmospheric motion, Equations of motion in absolute and rotating frame, Tangential and local coordinate system, Coriolis force, Scale Analysis, Rossby number, Natural Co-ordinate System, Trajectory and Stream lines, Blatons Equation, balanced flow-Geostrophic Flow, Inertial Flow, Cyclostrophic Flow and Gradient Flow. Equations of continuity in cartesian and isobaric co-ordinates. Thermodynamic energy equation, Pressure as vertical co-ordinate and Basic equations in Isobaric Coordinates. Generalized vertical co-ordinates. Differential Properties of wind Fields Translation, Divergence, Rotation and Deformation., Thermal Wind , veering and backing, Kinematics of Pressure Fields: Intensification and Weakening, Deepening and Filling. Vorticity and Circulation. Basic concepts of numerical weather prediction.

Detailed Syllabus of M.Sc. Biotechnology,

SEMESTER I

BT 11 BIOLOGICAL CHEMISTRY I

BT 11.1: BIOCHEMISTRY OF MACROMOLECULES AND BUILDING BLOCKS

(15L)

Macromolecules (Nucleic acids, proteins, carbohydrates and lipids) and their building blocks: amino acids, purine and pyrimidine bases, fatty acids and sugars.
Small molecules of biological importance: vitamins and minerals.

BT 11.2: Introduction to Enzymology, Metabolism and Bioenergetics (15L)
Enzymes: classification, catalysis, kinetics, regulation (fine, coarse and metabolic control). Coenzymes and cofactors, and their relevant reactions. Allostery.
Metabolic pathways: glycolysis, Krebs cycle, pentose phosphate pathways, glycogen metabolism, fatty acid biosynthesis and oxidation, oxidative phosphorylation.
Thermodynamics in biological systems.

BT 11.3: BIOCHEMICAL TECHNIQUES

(15L)

Spectroscopy: UV-Vis, Fluorescence.
pH and Conductivity.
TLC, Chromatography, Radioactivity.
Native and SDS Polyacrylamide gel electrophoresis, 2 D electrophoresis.

BT 11.4: Introduction to Molecular Biology (15L)
Concept of gene (prokaryote and eukaryote).
Structure and organization of genome (gene family, gene cluster, repetitive DNA). Structure and function of chromatin.
DNA replication, transcription and translation.
Post translational modification and transport of proteins.

BT 12 CELL BIOLOGY

BT 12.1: Cell Structure and Methods in Cell Biology (15L)
Cell: structural and functional organization.
Cell motility.
Ultrastructure and Electron microscopy.
Fractionation of subcellular organelles.
Microscopy, Morphometry, Cell counting.

BT 12.2: Biomembranes and Trans-Membrane Signaling (15L)
Biomembranes: structure-function relationship.
Cell signaling: Cell surface, Hormone, receptors and signal transduction and second messengers.

BT 12.3: Cell Dynamics, Cell Differentiation, Cell Death, and Transformation (15L)

Cell dynamics, cytoskeleton and cell surface.
Extracellular matrix.
Cell-cell interactions and cell matrix interaction.
Cell lineages and the context of Developmental biology
Cell differentiation, hormones and growth factors.
Apoptosis.
The transformed cell.

BT 12.4: The Plant Cell (15L)

Plant cell wall - primary and secondary, role in growth and development.
Plamodesmata, role in sugar loading, virus transfer etc.
Plastids - biogenesis, structure and types, chloroplast-Nucleus interaction, Rubisco, photosynthesis.
Cytosenescence, cytoquiescence.

BT 13 QUANTITATIVE METHODS

BT 13.1: Biostatistics (15L)

Statistical population, sample from population, random sample.
Tabular and graphical presentation.
Mean and standard deviation of group and ungrouped data.
Probability, relative frequency, probability distribution.
Binomial, poisson and normal distribution.
Test of significance, test for proportion, means and standard deviations, F and t test, chi-square test for goodness of fit.
Theory of errors, errors and residuals, precision, measure of precision, probable error of function, rejection of observation.
Methods of averages and least squares.
Correlation and linear regression, associated test of significance.
Analysis of variance for one and two way classification.
Design of experiments, randomization, replication, local control, completely randomized and randomized block design.
Nonparametric tests.

BT 13.2: BIOMATHEMATICS

(15L)

Differential and integral calculus.
Derivative and its physical significance, basic rules for differentiation (without derivation) maxim and minima, their applications in chemistry, exact and inexact differentiation with specific emphasis on thermodynamic properties, partial differentiation.
Curve sketching.
Basic rules for integration (without derivations), definite and indefinite integrals, geometric meaning of integration, applications in the biology and chemistry.

Solutions to quadratic and cubic equations.
Differential equations.
Separable variable, homogeneous, exact and linear equation, equations of second order Applications of differential equations in chemistry.
Determinants evaluations of 3 x 3 determinants, matrices manipulations, simultaneous equations and inversion.
Interpolation and polynomial fitting.

BT 13.3: BASIC CONCEPTS IN COMPUTING

(15L)

Overview and functions of computer system.
Input and output devices.
Storage devices: hard disk, diskette, magnetic tape, RAID, ZIP devices, digital tape, CD-ROM, DVD (capacity and access time).
Main Circuit Board of a PC: chips, port, expansion slots.
Memory: register, buffer, RAM, ROM, PROM,EPROM, EEPROM (comparison).
Types of processing: Batch, real-time, online, offline.
History of computers; evolution, generation of computers (I,II,III,IV,V), classification of computers (main frames, mini computers, microcomputers, special purpose), comparison with memory, power, cost, size- then and now.
Types of modern computers: the workstations, the minicomputers, the main frame computers, parallel processing computers, the super computer.
An overview of computer viruses: what is a virus? Virus symptoms, how do they get transmitted ? what are the dangers ? general precautions.
Introduction to operating systems: operating system concept, windows 98.XP, windows server NT/2000, UNIX/LINUX.
The internet and its resources, world wide web (www): associated tools, services, resources and various terminologies.
Searches on medline, bibliographic databases, etc.

BT 13.4: COMPUTER NETWORKING (15L)

OSI reference model.
Network topologies and protocols.
Data communication (ISDN,VPN,DSL, cable modem, cellular modem, etc).
Communication links (wire pairs, coaxial cables, fibre optics, microwave, satellite, etc).
Local area network (LAN), wide area network (WAN), metropolitan area network (MAN).
Network security (firewall, packet filtering, etc).

SEMESTER II

BT 21 MOLECULAR BIOLOGY

BT 21.1: Genome Organization and Structure (15L)

Organization of viral, prokaryotic and eukaryotic genomes: DNA reassociation kinetics (Cot curve analysis), repetitive and unique sequences, kinetics and sequence complexities, satellite DNA, DNA melting and buoyant density.
Organelle genomes.
Rearrangement and amplification of DNA in the genome.
Genomics and proteomics.

BT 21.2: DNA Replication and DNA Repair (15L)

DNA replication models, DNA polymerases - mode of action.
DNA damage, DNA repair and recombination.
RNA polymerases and reverse transcriptase: structure and mechanism of action.
Enzymes involved in DNA modifications, methylases, demethylases, DNases, DNA gyrase, Topoisomerases.

BT 23.3: Structure-Function of Chromatin and Gene Expression (15L)

Chromatin structure and remodeling in relation to gene expression, DNase hypersensitivity, DNA methylation.
Transcription, its regulation and transcription factors.
Post-transcriptional processes and transport of RNA.
Organization and structure-function of ribonucleoproteins.
Protein synthesis: Genetic code, mechanism and regulation of protein synthesis.

BT 23.4: MOLECULAR BASIS OF DEVELOPMENT

(15L)

Molecular basis of development in animals and plants.
Homeobox gene expression and Pattern formation during development.
DNA methylation, gene expression, chromosomal inactivation and sex determination.
Oncogenes, proto-oncogenes and etiology of cancer.

BT 22 GENETICS

BT 22.1: Mendelian Genetics (15L)

Mendelian principles, Concept of Dominance, multiple allelic systems, sex-linked inheritance, Epistasis, Pleiotropy, Penetrance, Linkage studies, genetic maps.
Quantitative genetics and applications.
Plant genetics: Inbreeding and heterosis, and plant improvement.
Population genetics: Hardy-Weinberg law.
Sex determination and dosage compensation.
Mutation, Chromosomal aberrations.
Genotoxicity: detection and assays.
ANIMAL MODELS (*DROSOPHILA, CAENORHABDITIS*) IN THE STUDY OF GENETICS.

BT 22.2: MICROBIAL GENETICS (15L)

Gene mapping in phages, bacteria.
Point mutations, isolation of auxotrophs, conditional lethals and suppressor mutations.
Control of gene expression in bacteria. Operon concept-lactose, arabinose and tryptophane operons.
Genetics of biosynthetic pathways.
Transposons in prokaryotes and eukaryotes.
Mutagenesis: mutagenic agents, mechanisms of mutagenesis.
Expression of mutations- gene mutation.
Transformation.

Detection of DNA damage at molecular level, Ames test.

BT 23a MICROBIOLOGY

BT 23A.1: General Microbiology (15L)

Distribution, classification and life cycles of bacteria, fungi, anaerobes, cyanobacteria protozoa and others.
Growth kinetics, cultivation, propagation and preservation.
Handling pathogens.
Sterilization.
Antibiotics, drug resistance, MDR.

BT 23a.2: Applied Microbiology and Diagnostics (15L)

Nutrients and energetics Biomass, Y (ATP) and maintenance energy.
Microbiology for public health: mycobacteria, enterobacteria, and protozoa.
Anaerobes, soil bacteria, agrobacterium nitrogen fixation.
Extremophiles.
Industrially important microbes secondary metabolites, biotransformations, ethanol production.
Microscopic identifications, immuno probe tests, PCR application in diagnostic microbiology.

BT 23b VIROLOGY

BT 23b.1: General Virology (15L)

Classification of viruses.
Propagation of animal viruses.
Propagation of plant viruses & bacteriophages.
Morphology and ultrastructure of viruses.
Steps involved in virus replication.
Replication of viruses:
RNA viruses: polio and measles (+ve strand)
RNA viruses: VSV and influenza (-ve strand)
DNA viruses: pox, adeno, herpes
Retro viruses.
Replication of Bacteriophages.
Replication of Plant viruses.

BT 23b.2: Applied Virology and Diagnostics (15L)

Antivirals.
Anti-retrovirals.
si RNAs.
Viral diagnostics: Immuno diagnosis, molecular diagnosis.
Laboratory tests in viral diagnosis.
Viral vaccines (conventional).
New vaccine candidates: proteins and peptides, DNA.
Viral vectors.
Vaccine trials.
Antiviral Drug designing

BT 24 IMMUNOLOGY

BT 24.1: Immunology - I (15L)

Introduction, History, Phylogeny.
Immune system overview, innate and acquired immune system.
Components of immune system.
Structure and function of antibody.
Inflammation, opsonization.
Primary and secondary lymphoid organs.
Complement.
B cell, T cell ontogeny.
Characteristics of antigen, T cell dependent and independent antigens.
Hypersensitivity.
Primary and Secondary immune responses.
Techniques in humoral immunology.

BT 24.2: Immunology - II (15L)

BCR and TCR structure, γδTCR.
Generation of diversity.
MHC I and II gene, polymorphism.
Generation of immune response.
T helper, T cytotoxic cells.
MHC peptide interaction.
Antigen presentation, secondary signaling.
Immunological disorders and autoimmune diseases.
Lymphocyte traffic.
Techniques in cellular immunology.
Immune response to viral and bacterial lymphatic infection.

BT 25 BIOINFORMATICS (30 L)

Introduction to Biological Databases, Database Browsing and Data Retrieval
- Sequence databases
- Genome Databases

Application of Bioinformatics Approaches for analysis and interpretation of Sequence Data and using
- Homology Searches
- Sequence Alignments
- Pattern Searching

Application of Bioinformatics Approaches for analysis and interpretation of Genome data such as
- Gene prediction
- Full Genome comparison etc.

Introduction to computational structural biology
- Protein structure prediction using computational methods
- Structure analysis
- Classification of Proteins etc.

SEMESTER III

BT 31 TISSUE CULTURE (PLANT & ANIMAL)

BT 31.1: INTRODUCTION TO TISSUE CULTURE TECHNIQUES

(15L)

Introduction to tissue culture: Definition, principle and significance of tissue culture.
Animal tissue culture.
Maintenance of sterility and use of antibiotics, Mycoplasma and viral contaminants.
Various systems of tissue culture - their distinguishing features advantages and limitations.
Culture medium: Logic of formulation (natural media, synthetic media, and sera).
Methodology: i. Primary culture: Behaviour of cells, properties, utility.
ii Explant culture. iii. Suspension culture.
Development of plant tissue culture.
Totipotency of plant cells and its realization *in vitro.*
Nutrient media: obligatory and optional constituents.
Incubation systems: static agitated culture systems.

BT 31.2: ANIMAL CELL ORGAN CULTURE

(15L)

Cell lines: Definition, development, maintenance and management and Cell adaptation.
Established cell lines: Their characteristic features and utility, Cross contamination hazards.
Characteristics of cells in culture.
Contact inhibition, anchorage (in) dependence, cell-cell communication etc, Cell senescence.
Cell and tissue response to tropic factors, Culturing of different cells.
Designing of an experiment in tissue culture and response assessment. Significance of various controls.
Growth studies: Cell proliferation, cell cycle, mitosis in growing cells.
Organ culture: Methods, behaviour of organ explant, and utility of organ culture.
Organ transplants. Freeze storing of cells and transport of cultures.
Mass production of biologically important compound.
Harvesting of products, purification and assays.
Propagation of viruses (viral sensitivity of cell lines).
Cell cloning and cell synchronization.
Separation of cell types: Various methods: advantages and limitations; Flow cytometry.
Nuclear transplantation, Cell hybridization, Transfection studies.

BT 31.3: PLANT CELL, TISSUE AND ORGAN CULTURE

(15L)

Growth and differentiation of cultured cells and tissues.
Cytodifferentiation, organogenesis and embryogenesis.
In vitro culture: physical, chemical and genotypic factor.
Culture systems: organ, callus, cell and protoplast cultures.
Assessment of growth and development *in vitro.*
Plant Growth Regulators: mode and mechanism of action.
Secondary metabolism in cultured cells, increase of secondary metabolite production by suitable media supplements like elicitors, stress factors, precursor.
Tissue culture of lower plants, algae, lichens and bryophytes.

Genetic and epigenetic variation, spontaneous genetic variation, in vitro variation existing in cell populations or induced by culture conditions.

BT 31.4: Applications of Tissue Culture (15L)

Commercial applications of animal tissue culture: Tissue culture as a screening system. Cytotoxicity and diagnostic tests.

Development and preparation of vaccines against infecting organisms, mammalian cloning.

Establishment of cell lines from tissues of genetic diseases.

Applications of Genetic manipulations.

Commercial applications of plant tissue culture: Mass propagation, Medicinally important compounds.

Screening of cell lines for novel variations: disease resistant, stress tolerant

Transgenic plants.

BT 32 FUNDAMENTALS OF GENETIC ENGINEERING

BT 32.1: Basics of Genetic Engineering (15L)

General introduction and concept.

DNA modifying enzymes and restriction enzymes

Cloning strategies: Genomic libraries, cDNA libraries, single gene cloning.

Vectors in gene cloning: Types of vectors and choice of vectors- Plasmids, cosmids, lamda phage vectors, shuttle vectors, BACs and YACs

Choice of hosts, Methods for transferring recombinant DNA to host cells (Transformation and Transfection)

Screening and selection for transformants : Hybridisations- colony, Southern, Northern, Western, Detection (radioactive and non-radioactive procedures).

DNA sequencing techniques including automated DNA sequencing.

Site-directed mutagenesis.

BT 32.2: Expression Systems in Genetic Engineering (15L)

Various expression vectors in bacteria and eukaryotes.

Choice of appropriate hosts, Induced expression.

Chimeric constructs, Expression of industrially important products.

BT 33 BIOLOGICAL CHEMISTRY II

BT 33.1: Advanced TECHNIQUES IN BIOCHEMISTRY & MOLECULAR BIOLOGY

(15L)

Chromatography: gel permeation, adsorption (ion exchange, affinity), partition, HPLC, protein purification.

2-D analysis and Maldi-Tof in Proteomics

Centrifugation techniques.

Nucleic acids techniques: Agarose gel electrophoresis, various blotting techniques, PFGE, siRNA technology, Microarray analysis.

BT 33.2: TECHNIQUES FOR MACROMOLECULAR STRUCTURE

(15L)

IR, NMR, CD, X-ray diffraction- introducing the concept of lattice, symmetry, unit cell, crystal system etc., STM, MALDI- TOF.
Biochemical structures: proteins, nucleic acids, and lipids.
Secondary structure, Ramachandran plots, structure - function correlations, anatomy of biological macromolecules.
Sequencing of proteins and nucleic acids.

BT 34 BIOCHEMICAL ENGINEERING

BT 34.1: Theory and Design of Bioreactiors (15L)
Mathematical aspects of enzyme reactions and bio-reactors.
Simulation of reaction kinetics and reactors.
Construction and design of bioreactors.
Scaling up of processes.

BT 34.2: Transport and Process Control (15L)
Transport phenomena in biochemical engineering: mass transfer, heat transfer, mixing, rheology

BT 35 PLEURIPOTENT CELL TECHNOLOGIES AND REPRODUCTION

BT 35.1: CELLS OF REPRODUCTION AND EARLY DEVELOPMENT

(15L)

Gamets and fertilization
Early development: Metabolic activation, cytoplasmic rearrangement, embryonic induction, cell lineages, pattern formation.
Embryonic stem cells, cell differentiation
BT 35.2: STEM CELL CONCEPT AND TECHNOLOGIES

(COMMITTED CELLS AND LATE DEVELOPMENT

(15L)

STEM CELLS, EMBRYONIC STEM CELLS, DIFFERENTIATION.

ES CELL TECHNOLOGIES, TRANSGENICS AND KNOCK OUTS.

GENE THERAPY.

HUMAN CLONING AND BIOETHICS.

SEMESTER IV

BT 41 STRUCTURAL BIOLOGY

BT 41.1: Protein Crystallography and Structure Analysis (15L)

Symmetry, point groups, crystal systems, space groups
Representations of waves, equivalence of Laue and Brag's equations
Ewald's sphere and reciprocal lattice
Reciprocal lattice parameters, transformations, reciprocal lattice vector
Expression for structure factor, diffraction as Fourier transform
Atomic scattering factor, Mathew's number, total number of reflections
Systematic abscrises
Phase problem, patterson fuction, harker lines and planes
Isomorphous method and anomalous dispersion method
Harker construction
Statistical considerations of phase determination
Direct methods of structure determination
Stucture refinement, structure validation
Structure of proteins (examples)
Fibre diffraction

BT 41.2: Solution Studies (15L)

Application of NMR spectroscopy to determine structure of proteins and nucleic acids
2D NMR. (COSY, NOSEY, SECSY techniques) Nuclear Overhousser effect and its application in biopolymer structure determination.
Application of fluorescence spectroscopy in biopolymer structure determination.

BT 42 INDUSTRIAL BIOTECHNOLOGY

BT 42.1: Enzyme and Bioprocess Technology (15L)

Enzyme technology : Enzyme as biocatalysts, enzyme structure and function, applications of enzymes, immobilization of enzymes, in vitro-stability of enzymes.
Bioprocess technology: why R&D and pilot scale production, down stream processing, fermentation technology and operations, production processes for food, feed, therapeutic proteins, industrial enzymes, organic acids, ethanol production etc.

BT 42.2: Waste Management (15L)

Microbial bioremediation, conversion of municipal, agricultural, petrochemical, animal etc waste into industrially useful products. Composting, biogas production.
Costing and economics.

BT 43 Applications of genetic engineering

BT 43.1: APPLICATIONS TO MEDICINE AND AGRICULTURE

(15L)

Concept
Pharmaceutical products: Human protein replacement, Human therapies, vaccines
DNA analysis in diagnostics: Methods of DNA analysis, Indentification and diagnosis of genetic diseases, infectious diseases, environmental monitoring.
Gene therapy: types, vectors, methods, safety and advances.
Agriculture: Transgenic plants – enhancing resistance to pests, nutritional value, modification of ornamental plants, bioengineered food, vegetable vaccines, plantibodies, biopharming.
DNA marker technology in plants

DNA fingerprinting and forensic applications

BT 43.2: BIOINFORMATICS IN GENE AND PROTEIN ANALYSIS, IPR AND PATENTS, BIOSAFETY REGULATIONS

(15L)

Concept on data base in Protein and nucleic acids.
Various programmes for sequence comparison and analysis.
Human genome sequences.
Molecular modeling and structure function relationship.
Proteomics.
General concept of patenting, International and Indian Scenario, WTO.
Evolution of patenting system.
Biosafety regulation and practices in genetic engineering research.

BT 44 PLANT BIOTECHNOLOGY

BT 44.1: Plant Tissue Culture in Plant Propagation (15L)

Somaclonal variation: applications and limitations.
Exploitation for selecting superior phenotypes - disease resistant, stress tolerant, high secondary metabolite producing. Screening procedures.
Micropropagation - Seed versus soma, use of Micropropagation in multiplication of specific genotypes, rare and/or improved varieties, endangered species. Disease elimination.
Morphogenesis, regeneration of plantlets, multiplication of plantlets, rooting.
Hardening of micropropagated plants and their transfer to soil, Micropropagation methods for the following category of plants (one example for each category) (a) Floriculture (b) Horticulture (c) Medicinal and ornamental plants (d) Cereal, pulse, oilseed and fiber crops (e) Forest trees, fruit trees.
Problems in propagating trees namely systemic contaminants, phenolic leaching, seasonal variation in response, genotypic recalcitrance

BT 44.2: Advances in Plant Biotechnology and Genetic Manipulations (15L)

Commercial production of tissue cultured plants- (i) Technology transfer, equipment and procedures (ii) Asceptic techniques and control of contamination in a commercial laboratory, quarantine, pathological indexing., packaging, cost analysis, marketing.
Somatic embryogenesis system and artificial seed production.
Commercial production of secondary metabolites using cell cultures- Use of bioreactors, immobilized cells. Biotransformations. Applications and limitations.
Cryopreservation and ex situ conservation of germplasm.
Genetic improvement of plants through tissue culture- comparison with classical methods

(a) Transgenic plants, antisense RNAs, tissue specific sequences, elimination of plant viruses.
(b) Homozygous plant production through anther, ovule, pollen cultures.
(c) In vitro pollination and fertilization, embryo rescue endosperm culture and production of seedless plants.
(d) Protoplast culture and its use in genetic improvement: (i) Somatic hybridization, cybrids: limitations (ii) Micromanipulation of genes using protoplasts.
Genetic engineering in plant biotechnology.

BT 45 CHEMICAL SYNTHESIS AND SCREENING IN BIOTECHNOLOGY

BT 45.1: Synthesis and Interaction of Biological Macromolecules (15L)

Synthesis of oligonucleotides and their uses in diagnostics.
Synthesis of oligopeptides.
Synthesis of polysaccharides: principles and applications.

BT 45.2: Conceptualization of Drug molecules (15L)

High throughput synthesis and high throughput screening.

BT 46 GENOMICS AND PROTEOMICS

BT 46.1: Genomics (15L)

Introduction to genomics, sequencing strategies for whole genome analysis, sequence data analysis.
Comparative genomics, genome annotation.
Structural genomics.
Functional genomics.
Global analysis of gene expression.
Transcriptomics and microarray.
Toxicogenomics.
Pharmacogenomics.

BT 46.2: Proteomics (15L)

Strategies in proteomics.
Structural/functional proteomics.
Proteomics methodologies.
Computational approach for studying protein–protein interactions.
Proteomics applicatioons: drug development, screening of diagnostic markers, identification and characterization of novel proteins.

BT 47 IMMUNOTECHNOLOGY

BT 47.1: Molecular Immunology (15L)

Cytokines.
T cell education, Affinity maturation.
Immunological Memory.
Cell-cell interaction, signal transduction.
Development of tolerance.
Characteristics of T helper and Tc TL and B cell peptide.
Transplant immunology.
Bone marrow chimera.
Auto immunity, molecular mimicry, Therapy.
Monoclonal antibody.
Techniques in molecular immunology.
Network theory.

BT 47.2: Immunotechnology (15L)

Animal models and transgenic animals and their use in immunology.
Experimental immunology.
Vaccine development.

Stem cell technology.
Molecular modeling and Bioinformatics.
Chimeric antibodies, phage display, antibody engineering.
Large scale manufacture of antibodies.
Manufacturing of immuno diagnostics.
Recombinant vaccines, combined vaccines, polyvalent vaccines.

Entrance Examination: Ph. D. in Computer Science

Following are the broad areas under which the candidate appearing for Ph.D. entrance test will be examined. Topics covered in the books following each subject area, upto the postgraduate level comprises the syllabus for this test. Alternate books, references which cover the same topics may be used instead. Candidates are expected to have basic proficiency in programming. No specific programming language for the test is expected. Subjects:

1. Theory of Computing

Introduction to Algorithms, Cormen, Leiserson, Rivest, Klein, MIT Press.

Introduction to Automata theory, Languages and Computation**,** John E. Hopcroft**,** Rajeev Motwani**,** Jeffrey D. Ullman**,** Pearson Education

2. Operating Systems

Operating System Concepts, Avi Silberschatz, Peter Baer Galvin, Greg Gagne, John Wiley Publication.

The Design of UNIX Operating System, M. Bach, Pearson Education

3. Computer Architecture

Computer Architecture: A Quantitative Approach, J. Hennessy, D. Patterson, Pub. Morgan-Kaufman

Computer Organization and Design, J. Hennessey, D. Patterson, Elsevier India Private Limited

4. Databases

Database Management Systems. by *Raghu Ramakrishnan* and Johannes Gehrke, McGraw-Hill Higher Education

5. Networking

Computer Networks, A. Tanenbaum, Pearson Education

6. Programming Languages and Translators

Programming Languages: Concepts and Constructs, Ravi Sethi, Addison Wesley

Compilers: Principles, Techniques, and Tools, Alfred V. Aho, Monica S. Lam, Ravi Sethi, and Jeffrey D. Ullman, Pearson Education

Linker and Loaders, J. Levin, Morgan-Kaufman

System Software: An Introduction to Systems Programming, *Leland L. Beck, Pearson* Education

7. Computer Graphics

Computer Graphics: Principles and Practice in C, James D. Foley, Andries van Dam, Steven K. Feiner, John F. Hughes, Addison Wesley

8. Artificial Intelligence

Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, Prentice Hall

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School Of Energy Studies
University of Pune

Syllabus for PhD Entrance Examination February -2010

(PhD in Physics, Energy)

Basics of Thermodynamics

Basic Units, Dimensions and Conversions For Energy, Concepts of Energy, Heat and Work, Ideal gas law, Ist and II law of thermodynamics (Closed and Open Systems)

Thermodynamics power cycles, Reversible heat Engine cycle, I.C. engine cycles, Carnot Cycle, Rankine Cycle, Otto Cycle, Vapor Refrigeration & power Cycle etc.

Classification of Energy Sources

Classification of Energy Sources,

Principle fuels for energy conversion: Fossil fuels, Nuclear fuels.

Conventional & Renewable Energy

Energy Sources: prospecting, extraction and resource assessment and their peculiar characteristics.

Direct use of primary energy sources, Conversion of primary into secondary energy sources such as Electricity, Hydrogen, Nuclear energy etc.

Energy Conversion through fission and fusion, Nuclear power generation etc.

Basics of Mechanical Engineering (Energy Related)

Sterling Engines, Steam Engine, Internal Combustion systems and external combustion system, Overview of different types of turbines.

Mechanical Engineering and Overview: Basic Engineering concepts and design considerations, Governing regulations and codes and standards,

Strength of Materials, mechanical properties of materials, mechanics of materials

Torque and Power: Basic theory, Shafts, Flywheels etc.

Power Transmission: Concepts of Belts Drives, Gearing, Coupling etc.

Bearing and Lubricants as Energy Saving Measures

Electromechanical energy: Electric to mechanical energy conversion, Electric Motors.

Basics of Electrical Engineering (Energy Related)

Fundamentals of Electricity: Concepts of different electrical parameters like voltage, current, frequency, D.C and A.C circuits, Electrical power and energy.

Electrical loads – Resistive, Inductive and Capacitive.

Phasor Notation, Power in A.C. Circuits, Single and Three Phase A.C. Power, Star and Delta connections, Voltage levels.

Transformers, Generators, Alternators etc.

Conversion of Thermal, Chemical, Electromagnetic and Mechanical energy into electricity.

Electrical Energy Sources

Importance of Electrical energy in modern industrial society, Production of electricity using coal, oil, natural gas, nuclear fuels and hydel ,-its relative advantages and disadvantages (i.e. conversion of Thermal, Nuclear, hydel energy into electric energy)

Electricity generation using Renewable Energy Sources: Basic Principles and Applications. (Conversion of Electromagnetic energy and natural energy sources like solar radiation, Wind, Ocean waves, Solid waste etc. to electricity)

Conversion of chemical energy into electrical energy (fuel cell)

Thermal power plant, nuclear power plants and hydroelectric power plant, Transmission and distribution of electricity, Villages electrification program and problems in India.

Solar Energy

Sun as Source of Energy, Availability of Solar Energy, Nature of Solar Energy, Solar Energy & Environment.

Various Methods of using solar energy –Photothermal, Photovoltaic, Photosynthesis, Present & Future Scope of Solar energy.

Hybrid wind energy systems - wind + diesel power, wind + conventional grid, wind + Photovoltaic system etc.

Bio-mass

Biomass: Generation and utilization, Properties of biomass, Agriculture Crop & Forestry residues used as fuels.

Biochemical and Thermo-chemical Conversion, Combustion, Gasification, Biomass gasifiers and types etc.

Applications of Gasifiers to thermal power and Engines, Biomass as a decentralized power generation source for villages

Concept of Bio-energy**:** Photosynthesis process, Bio-fuels, Biomass resources Bio based chemicals and materials

Thermo-chemical Conversion: Pyrolysis, Combustion, Gasification, Liquification.

Bio-Chemical Conversion: Aerobic and Anaerobic conversion, Fermentation etc.
Bio-fuels: Importance, Production and applications.

Bio-fuels: Types of Bio-fuels, Production processes and technologies, Bio fuel applications, Ethanol as a fuel for I.C. engines, Relevance with Indian Economy.

Bio-based Chemicals and Materials: Commercial and Industrial Products, Biomass, Feed stocks, Chemicals, Plastics, Fibres etc.

Government Policy and Status of Bio fuel technologies in

Biomethanation

Importance of biogas technology, Different Types of Biogas Plants.
Aerobic and anaerobic bioconversion processes, various substrates used to produce Biogas (cow dung, human and other agricultural waste, municipal waste etc.)
Individual and community biogas operated engines and their use.
Removal of CO_2 and H_2O, Application of Biogas in domestic, industry and vehicles.
Bio-hydrogen production.
Isolation of methane from Biogas and packing and its utilization.

Wind Energy

Wind Energy: Basics & Power Analysis,

Wind resource assessment,

Power Conversion Technologies and applications,

Wind Power estimation techniques,

Principles of Aerodynamics of wind turbine blade,

Various aspects of wind turbine design,

Wind Turbine Generators: Induction, Synchronous machine, constant V & F and variable V & F generations, Reactive power compensation.

Site Selection,

Concept of wind form & project cycle,

Cost economics & viability of wind farm,

Energy Storage

Need and importance of Energy storage in Conventional and Nonconventional Energy Systems. Technical Aspects (Measurements, Quantify)
Various forms of Energy Storage: Thermal, Chemical, Mechanical, Electrical and Nuclear Techno Commercial Analysis (Economical aspects),
Energy Storage: Devices and Systems.

Hydrogen Energy
Hydrogen as a renewable energy source, Sources of Hydrogen, Fuel for Vehicles.

Hydrogen Production: Direct electrolysis of water, thermal decomposition of water, biological and biochemical methods of hydrogen production.

Storage of Hydrogen: Gaseous, Cryogenic and Metal hydride

Fuel Cell - Fuel cell – Principle of working, construction and applications.

Nuclear Energy

Basics of Nuclear properties, size, shape, charge distribution, spin n parity, binding,
Nature of nuclear force, Evidence for nuclear shell structure,
Basic principles of particle detectors – ionization chambers.
Radioactive decays (alpha, beta, gamma), their classifications and characteristics.

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Department of Geography
University of Pune

M.Phil/Ph.D. Entrance Exam Syllabus for Geography subject

Climatology

Unit 1: General Climatology and Synoptic Climatology

i) Development of modern climatology and tropical climatology.
ii) Atmosphere: composition & structure, Heat budget, Air masses, Fronts, Cyclones and anticyclones, Thunderstorms, Atmospheric circulation, Pressure and winds, Lapse rate, Stability and instability of atmosphere, climate change: theories and causes.
iii) Classification of climates – Emperic & Generic, Koppen's and Thornthwaite's shemes of classification, Station Model, coding and decoding of synoptic data, Climatic maps and diagrams.

Unit 2: Monsoon Climatology

i) Definitions of monsoon, Historical background.
ii) Classical theory of monsoon, East and south Asian monsoon, Monsoon model: driving mechanism, realistic monsoon model, onset and withdrawal; temperature, pressure, wind distribution, Interseasonal and interannual variation, monsoon forecast.
iii) Preparation of temperature, rainfall, pressure, etc. distribution maps, Use of Tephigram,

Unit 3: Agro-meteorology and Applied Climatology

i) Development of Agro-meteorology and applied climatology.
ii) Plants and energy related agrometeorological elements, plants and moisture related agrometeorolgical elements, Droughts
iii) Methods for computing PET, Agroclimatic classification, Agroclimatic indices, Comfort indices, Heat and cold wave analysis, climate and architecture

Population / Settlement Syllabus

Unit 1. Population Geography

i) Nature, scope and concepts of Population Geography (Mortality, Fertility, Migration and nuptiality),
ii) Approaches to the study of Population Geography. Demographic transition Theory, Pre Malthusian and post Malthusian theories.
iii) Population problems in developed and developing countries, recent trends in population Geography.

Unit 2. Urban Geography

i) Concepts in Urban Geography- Urban hinterland, Conurbation, Suburbanization, Rural-urban Divide,
ii) Urbanization curve, Morphological models in urban Geography, Central Place theory.
iii) Problems of urbanization and recent trends in urban Geography.

Unit 3. Rural Geography

i) Distribution of Rural Settlement, Size and spacing Rural Settlement.
ii) Land holdings and land tenure system, Concentration and dispersion of rural settlements.
iii) Problems in rural India and recent trends in Rural Geography

Economic Geography

Unit 1 : Agricultural Geography

i. Nature, Scope and significance of Agricultural geography. Approaches to the study of Agricultural geography, Place of Agriculture in the world and regional economies.
ii. Factors influencing agricultural patterns – physical and non-physical determinants, Agricultural regionalization.
iii. Agricultural systems of the world – Nomadic herding, shifting cultivation, intensive subsistence village, mixed farming, commercial grain farming, plantation agriculture.

Unit 2 : Geography of Resource and Development

i. Need for study of Resource Geography, Classification of Resources, Natural resource distribution.
ii. Human resources, conservation of resources, Resources and development
iii. Growth and development, Characteristics of Development and Developing economies, Economic Systems.

Unit 3 : Transport and Trade Geography

i Meaning of transport Geography, Types of transportation, transport network and its measurement
ii Problems of urban transport, factors associated with modes of transport
iii Trade definition, characteristics of trade, Different trade theories, International Trade

Unit 4 : Industrial geography

i Nature and scope basis of industrialization
ii Models of industrial location : Weber, Losch, Greennut, and Isard's models
iii Industrial Regions of India

Geomorphology

Topic	Sub-topics	Learning points
GEOMORPHOLOGY	Fundamentals of geomorphology	1) History of Geomorphology 2) Concepts, Paradigms, Theories, Approaches and Models in geomorphology 3) Role of climate, geology, structure, tectonics and time
	Geomorphic process and landforms	Processes and landforms associated with 1) Weathering 2) Mass movement 3) Soils 4) Fluvial 5) Coastal 6) Glacial 7) Aeolian 8) Karst
	Techniques and Methods in Geomorphology	Qualitative **methods** and analytical **techniques** – 1) Geomorphometry 2) Geomorphic mapping 3) Process studies 4) Sediment analysis 5) Terrain evaluation 6) Geo-statistical methods 7) Radiometric dating 8) DEM-based studies 9) Remote sensing and GIS 10) Modeling

UNIVERSITY OF PUNE

INTERDISCIPLINARY SCHOOL OF HEALTH SCIENCES

Ph.D ENTRANCE EXAMINATION

The Interdisciplinary School of Health Sciences offers a Ph.D. programme in Health Sciences.

Number of seats : 8

Eligibility : Masters degree in Health Sciences, public health and related disciplines of life sciences, social sciences, statistics, clinical sciences and pharmaceutical sciences.

Examination Modality :
Paper A : Common Entrance Examination – 100 marks
Paper B : Special paper – 100 marks
Interview – 100 marks

Syllabus for Paper B :

a) Part I : 20 x 1 mark questions on subjects relating to public health, medical microbiology, genetics, immunology, biostatistics, social issues, events and policies.

b) Part II : Comprehension, analytical skills and writing ability relating to a health issue

- 5 mark x 10 questions
- 15 mark x 2 questions

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University of Pune
Ph.D. Entrance Examination and Course work in Microbiology

I] Ph.D. Entrance Examination in Microbiology

A] General Structure of the Entrance examination :

Paper	Time in minutes	Nature of questions	Total Ma
Paper I General Aptitude	60	MCQs	100
Paper II Subject Paper	120	Objective & Descriptive	100
Interview	--	--	50

B] Syllabus for Paper I (General Aptitude):

Common for all faculties. 50 % passing (5% relaxation for reserved category). Paper I would be a qualifying exam only.

Syllabus for Paper II (Microbiology):

M.Sc. Microbiology (credit based) curriculum of University of Pune (available on university website).

C] Structure of Paper II (Microbiology):

The Paper II (Microbiology) consists of two parts as follows:

Paper	Time in minutes	No. of Questions	Marks
Paper II A	20	20 (One mark each)	20
Paper II B	100	8 (Ten marks each)	80

Paper IIA- All questions compulsory. No negative marking

Paper II B- will have 15 descriptive questions. Q1. Compulsory. Students have to attempt any 7 of the remaining 14 questions.

D] Interviews

Students clearing Paper II would be called as per merit for the interviews. All students who have cleared CSIR-NET, UGC-NET, SET, ICMR, ICAR, and GATE would be exempted from Paper I and II and would appear directly for the interview. Candidates would be interviewed by a committee appointed by the University. Admissions would be given as per the number of vacancies available. The choice of research topic that the candidate wishes to work on and the available expertise and infrastructure in the Department would be considered for deciding the Ph.D. admission of the candidate. Once admitted the candidate will undergo a course work at the department.

II] Ph.D. Course Work : (Duration 6 months)

Component	Credits	Syllabu
I (Common for Science faculty)	5	--

II (Theory)	5	**Problem solving a** **Biology** Students would learn problems on various experiments in geneti immunology, environ microbiology, molecu etc. and statistical ana
III (Practical)	5	**Techniques in** Students would experiments in whic handle all equipmen research experiments also learn working, calibration of other equipments used practice
IV (Fieldwork)	5	**Writing and publish** **article** Student would write article on a topic of h interest and publish t peer reviewed journa

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Ph. D. Entrance Examination in Statistics
Syllabus for Paper II

Nature of the Paper:

Duration: 2 hours, **Maximum marks:** 100

Structure of the Paper:

Section	Description	Marks
1	Multiple Choice Objective questions (10)	20
2	Descriptive (core topics) (2 out of 4)	40
3	Descriptive (specialization topics) (2 out of 6)	40

Section 1: Multiple choice objective type questions.

This section will have 10 multiple choice objective questions with four choices in every question. Further, exactly one of the options will be the correct answer. Two marks for a correct answer, zero marks for a wrong answer or for not attempting a question. No negative marks.

Section 2: Descriptive questions on core topics.

This section will have a total of 4 questions and a candidate has to answer any two of these four. There will be one question on each of the following topics. Every question has a maximum of 20 marks. All questions carry equal marks.

1. Mathematical Analysis

Countability, supremum and infimum of sets of real numbers. Limit point of a set – open sets, closed sets etc. (developed through general metric space and R^n being considered as a special case), compactness, Bolzano-Weierstrass theorem, Heine-Borel Theorem. Continuous functions, uniform continuity, absolute continuity. Sequences and series of real numbers, limit superior, limit inferior and limit of a sequence. Cauchy sequences, convergence of series, tests for convergence of series, absolute convergence, Cauchy products.

Riemann and Riemann – Stieltjes integrals, integration by parts, mean value theorem. Uniform convergence of sequences and series. Term by term differentiation and integration, applications to power series. Improper Riemann – Stieltjes integrals: Improper integrals of first and second kind for one variable. Uniform convergence of improper integrals, differentiation under the sign of integral – Leibnitz rule.

2. Probability Distributions

Random Experiment and its sample space, random variables, c. d. f. , p. d. f. , p. m. f. , absolutely continuous and discrete distributions, mixtures of probability distributions. Some common distributions. Transformations, moments, m. g. f. , p. g. f. , quantiles and symmetry. Random vectors, joint distributions, joint m. g. f. mixed moments, variance covariance matrix. Hazard rate and cumulative hazard rate, lack of memory property. IFR, IFRA, DFR and DFRA classes of distribution.

Independence, sums of independent random variables, convolutions, conditional expectation and variances, regression function and best linear regression function, multiple and partial correlation coefficients.

Sampling distributions of statistics from univariate normal random samples, such as linear and quadratic forms. Fisher Cochran theorem. Non-central chi-square, t and F distributions.

Order statistics: Distribution of r-th order statistic, joint distribution of several order statistics and their functions.

Probability Integral Transformation, Rank orders and their exact null distributions. One and two sample examples of rank statistic such as sign statistic, Wilcoxon signed rank statistic, Wilcoxon two sample statistic etc. Recurrence relations for the null distribution of the Wilcoxon two sample statistic.

3. Probability Theory

Algebra of sets, fields and sigma-fields, limit of sequences of subsets, sigma-field generated by a class of subsets, Borel fields. Probability measure on a sigma-field, probability space, continuity of a probability measure, real and vector-valued random variables (r. v. s), distribution functions (d. f.), discrete r. v. s, r. v. s of the continuous type, decomposition of a d. f.

Expectation of a real r. v. and of a complex-valued r. v. Linear properties of expectations. Characteristic functions, their simple properties, uniqueness theorem.

Convergence of a sequence of r. v. s. , convergence in distribution, convergence in probability, almost sure convergence and convergence in quadratic mean and , their inter-relations. Cramer's theorem on composition of convergence in distribution and convergence in probability. Slutkey’s theorem. Monotone convergence theorem and dominated convergence theorem.

Independence of two events and n (> 2) events, sequence of independent events, independent classes of events, π-system and λ-system of events, Dynkin's theorem, independence of r. v. s, Borel zero-one law.

Khintchin's weak law of large numbers, Kolmogorov strong law of large numbers (without proof), continuity theorem for characteristic functions. Lindeberg's CLT and its particular cases,

4. Parametric Inference

Sufficiency, completeness, Uniformly minimum variance unbiased estimators, C-R inequalities, exponential class of densities and its properties, some special classes of distributions admitting complete sufficient statistics, extensions of these results to multi-parameter situation.

Test function, Neyman- Pearson lemma for test functions. Uniformly most powerful tests for one sided alternative for one parameter exponential class of densities and extension to the distributions having monotone likelihood ratio property.

Confidence Intervals, shortest expected length confidence intervals, relations with testing of hypotheses, uniformly most accurate confidence intervals.

Bayesian estimation, prior distributions, posterior distribution, loss function, principle of minimum expected posterior loss, quadratic and other common loss functions, conjugate prior distributions. Common examples. Bayesian HPD confidence intervals.

Section 3: Descriptive questions on specialization topics.

This section will have a total of 6 questions and a candidate has to answer any two of these six. There will be one question on each of the following topics. Every question has a maximum of 20 marks. All questions carry equal marks.

1. Regression Analysis

Simple regression with one independent variable(X), assumptions, estimation of parameters, standard error of estimator, testing of hypothesis about regression parameters, standard error of prediction. Testing of hypotheses about parallelism, equality of intercepts, congruence. Extrapolation, optimal choice of X. Diagnostic checks and correction: graphical techniques, tests for normality, uncorrelatedness, homoscedasticity, lack of fit, modifications like polynomial regression, transformations on Y or X, WLS. Inverse regression X(Y).

Multiple regression: Standard Gauss Markov Setup. Least square(LS) estimation, Error and estimation spaces. Variance- Covariance of LS estimators. Estimation of error variance, case with correlated observations. LS estimation with restriction on parameters. Simultaneous estimation of linear parametric functions. Test of Hypotheses for one and more than one linear parametric functions. Confidence intervals and regions. ANOVA.

Non Linear regression (NLS): Linearization transforms, their use & limitations, examination of non linearity, initial estimates, iterative procedures for NLS, grid search, Newton-Raphson , steepest descent, Marquardt’s methods.

Logistic Regression: Logit transform, ML estimation. Tests of hypotheses, Wald test, LR test, score test. Test for overall regression. Multiple logistic regression, forward, backward method. Interpretation of parameters relation with categorical data analysis.

Generalized Linear model: link functions such as Poisson, binomial, inverse binomial, inverse Gaussian, gamma.

2. Multivariate Analysis

Multivariate normal distribution, pdf and mgf, singular and nonsingular normal distributions, distribution of a linear form and a quadratic form of normal variables, marginal and conditional distributions. Multiple regression and multiple and partial correlation coefficients, Definition and relationships.

MLE's of the parameters of multivariate normal distribution and their sampling distributions (including derivation of Wishart distribution) Properties of the Wishart Distribution. Tests of hypothesis about the mean vector of a multinormal population, Hotelling's T^2 -statistic and its distribution. Rao's U -statistic and its distribution, Applications of Hotelling's T^2 -statistic.

Introduction to Principle Components , Canonical correlation coefficients, and canonical variables.

Cluster Analysis.

Classification problem. Discriminant analysis, Mahalanobis D^2-statistic. Methods and applications of MANOVA (without derivation of the distribution of Wilks' lambda) .

3. Stochastic Processes

Markov chains with stationary transition probabilities, properties of transition functions, classification of states, Stationary distribution of a Markov chain, existence and uniqueness, convergence to the stationary distribution. Methods based on Markov chains for simulation of random vectors. MCMC algorithm.

Gambler’s ruin problem, Transient states. Estimation of transition probabilities. Numerical Illustrations and calculations of transition probabilities.

Branching processes.

Introduction to Wiener Process and Brownian Motion.
Markov pure jump processes, Poisson process, Birth and Death processes. Finite state continuous time Markov chains.

Renewal processes, Poisson process as a renewal process, elementary renewal theorem. Statement (without proof) of other renewal theorems.

Simple queuing systems.

4. Asymptotic Inference

Consistency and asymptotic normality (CAN) of real and vector parameters. Invariance of consistency under continuous transformation. Invariance of CAN estimators under

differentiable transformations, generation of CAN estimators using central limit theorem. Method of moments, method of maximum likelihood, Special cases such as exponential class of densities and multinomial distribution, Cramer-Huzurbazar theorem, method of scoring.

Tests based on MLEs. Likelihood ratio tests, asymptotic distribution of log likelihood ratio, Wald Test, Score Test, locally most powerful tests. Applications to categorical data analysis, three dimensional contingency tables, Pearson's chi-square test and LR test. Asymptotic comparison of tests. Asymptotic Relative Efficiency (Pitman's), asymptotic normality of posterior distributions.

5. Design of experiments and Analysis of Variance

Randomization, replication, local control, one way and two way classification with unequal and equal number of observations per cell (with / without interactions). Connectedness, balance, orthogonality, BIBD, ANOCOVA.

2^k Full factorial experiments: diagrammatic presentation of main effects and first and second order interactions, model, analysis of single as well as more than one replicates, using ANOVA.

Total confounding of 2^k design in 2^p blocks, $p \geq 2$. Partial confounding in 2^p blocks, $p = 2, 3$. Fractional factorial experiments. Resolution of a design, (III, IV & V), aberration of a design. Plackett-Burman design.

3^k designs: contrasts for linear and quadratic effects , statistical analysis of 3^k design, confounding and fractional experiments in 3^k design.

Response surface methodology (RSM): linear and quadratic model, stationary point, Central composite designs(CCD), ridge systems, multiple responses, Concept of rotatable design, Spherical CCD, Box-Behnken design, face-centered CCD, equiradial designs, small composite designs, blocking in RSM, optimal designs, simplex lattice designs, simplex centroid designs.

Taguchi methods: concept of loss function, S/N ratio, orthogonal arrays, triangular tables, linear graphs, inner and outer arrays.

Random effect models and mixed models. Restricted and unrestricted mixed models. Nested and split-plot designs.

6. Sampling Methods

Basic methods of sample selection, simple random sampling with replacement (SRSWR), simple random sampling without replacement (SRSWOR), probability proportional sampling with and without replacement, systematic sampling, estimation problems, Horwitz-Thompson estimator and its properties.

Stratification: Allocation problems and estimation problems, formation of strata and number of strata, method of collapsed strata.

Use of supplementary information for estimation, ratio and regression estimators with their properties and generalizations, Jackknife methods.
Cluster sampling, multistage-sampling. Double sampling procedures, Ratio and regression estimators, stratification.

Non-sampling errors, response and non-response errors and their treatments, randomized response.

University of Pune
Syllabus for PhD Entrance Test
Paper II – Engineering

Note: *1. This syllabus is for the PhD entrance tests conducted in year 2010 only.*
2. Paper II is common for PhD program in all branches under the Faculty of Engineering.

1. Mathematics [35 Marks approx.]

1.1 Statistics

1.1.1 Collection and classification of data
1.1.2 Graphical representation of data (frequency polygon, histogram, cumulative frequency curves)
1.1.3 Measure of central tendency – Mean, Median and Mode
1.1.4 Measures of dispersion- mean deviation, standard deviation, quartile deviation and
variance.
1.1.5 Moment, skewness and kurtosis.
1.1.6 Bivariate analysis – correlation and regression (linear)
1.1.7 Probability – Sample space Event and types of events, Classical definition of probability
and Axiomatic approach of probability, Addition theorem on probability, Conditional probability and Multiplication theorem on probability Baye's ,theorem, Probability model.

1.2Differential Equations

1.2.1 Definition and basic concepts such as order, degree and solution of a differential
equation.
1.2.2 Ordinary differential equation.
1.2.3 Linear differential equations with constant and variable coefficients.
1.2.4 Definition of partial differential equation and different types of partial differential equation.

1.3 Matrices

1.3.1 Definition of a matrix, types of matrices
1.3.2 Algebra of matrices
1.3.3 Inverse of a matrix by Adjoint method and by elementary transformation.
1.3.4 Rank of a matrix
1.3.5 Eigen values, Eigen vectors
1.3.6 Caley Hamilton theorem and inverse by Caley Hamilton theorem.
1.3.7 Solution of simultaneous homogeneous and non-homogeneous system of equations.

2 Technology Management [20 Marks approx.]

2.1. Definition of Technology, Management and its relation to society.
2.1.1 Classification of Technology, Management of Technology at various levels.
2.1.2 Role of Technology in creation of wealth. Its impact on National Economy.
2.1.3 Ethics in technology management
2.2 Critical Factors in Technology Management
2.2.1 Problem identification

2.2.2 Importance of creativity
2.2.3 Knowledge management
2.2.4 Relation and importance of pure sciences with Technology
2.3 Protection of Technology- Idea, Invention, Innovation and Intellectual Property
2.3.1 Tools of intellectual property
2.3.2 Patentability aspects, inventions, innovations.
2.3.3 Filing patent applications- processes
2.3.4 Patent Search
2.3.5 International conventions for protection of technology
3 Fundamentals of Computer Science [25 Marks approx.]
3.1 Number Systems and logic Gates
3.2 Computer Architecture
3.3 Primary Memory and Secondary storage
3.4 Input and Output Devices
3.5 Basics of Operating Systems
3.6 Database Fundamentals
3.7 Internet Basics
3.8 Algorithms & flowcharts
3.9 Programming Planning Tools
3.10 Characteristics of Programming Language
3.11 Elementary Programming of C languages (up to Arrays)
4. Research methodology [20 Marks approx.]
4.1 Research methodology: Basic concept
4.1.1 Meaning of research
4.1.2 Objective of research
4.1.3 Motivation in research
4.1.4 Types of research
4.1,5 Research approaches
4.1.6 Significance of Research
4.1.7 Research methods and Methodology
4.1.8 Research process
4.1.9 Criterion for good research.
4.1.10 Outcomes of Research
4.2 Research Problem
4.2.1 What is a research problem?
4.2.2 Selecting the Problem
4.2.3 Necessity of Defining the Problem
4.2.4 Techniques involved in defining a research problem.
4.2.5 Different ways of literature survey.
4.2.6 Different methods of data collection.
4.2.7 Methods of Analysis and Interpretation of Findings
4.3 Research design
4.3.1 Meaning of research design
4.3.2 Need of research design
4.3.3 Development of research plan
4.3.4 Research Report- Components in the Report, Writing the References/ Bibliography
Reference Books:
Mathematics
1. Gupta S.P. "Statistics", S. Chand Publication, Delhi

2. Kreyzing Erwin. " Advanced Engineering Mathematics", John Wiley and Sons, INC. New York.

Technology Management

1. Tarek Khalil "Management of Technology", University of Miami, Tata McGraw Hill Publishing
Company Limited, New Delhi.
2. Satyawrat Ponkshe "The Management of Intellectual Property", Bhate & Ponkshe Publications,
Pune.

Fundamentals of Computer Science

1. ITL Education Solutions Limited, "Introduction to Computer Science", Pearson Education(LPE)
2. Behrouz A. Foruzan, Richard F. Gilberg, "Computer Science- A Structured Programming approach Using C", Indian Edition, CENGAGE Publication, 3rd edition.

Research methodology

1. Kothari C. R. "Research methodology; Methods and techniques", New Age International Publishers, New Delhi.

2. Briony Oats. Researching Information Systems & Computing, SAGE Publishers

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Communication Studies

Syllabus for Ph.D. Entrance,Paper-II

Department of Communication Studies in University of Pune was established in July 1990. University of Pune was one of the first universities in India to recognize that academic training in Communication means much more than mass communication in general and journalism in particular. The Department was therefore, named as 'Department of Communication Studies'. The name and the course are thus in tune with the trend in the academics as well as in the industry. Department has been successfully running a two years full time Masters Course in Communication Studies (M.Cm.S.) and doctoral programme (Ph.D) In communication Studies. While expanding the scope of academic training beyond journalism, Department has identified Video Production and Media Research as its strength areas. Over the years, the course has also incorporated emerging areas in the fields of mass communication, interpersonal and organizational communication while keeping our strength areas in focus.
This constant endeavor to tune in to the demands of the ever-changing media industry and maintain high academic standards has earned the Department its reputation as one of the best courses in the field of Communication Studies in India.

Admission Requirements for Doctoral Programme in Communication Studies
The minimum academic qualification for admission to the Ph.D. Programme is a Second Class Master's or equivalent degree in the relevant subject awarded by a recognized university in India or abroad, with at least an average of 50 per cent of aggregate marks

Candidates having masters degree in communication studies or mass communication and journalism have a choice to take any one of the entrance test offered by the above mentioned departments depending on the interest of the candidate.

NET/SET cleared candidates are exempted from the entrance test. and these candidates are open to attend the interviews of both the departments of the University i.e Communication Studies and Mass communication and Journalism

Communication Studies
Syllabus for the Ph.D Entrance Examination (Paper II-subjective)

Understanding communication studies

- *concept and definition of communication*
- *Inter-disciplinary nature of the subject*
- *Types and forms of communication*
- *Semiotics and rhetorics*
- *Mass communication and its process*

- *Media structure and Institution*
- *Development of media technologies*
- *Media as a social Institution*
- *Media effects*

Broadcast technologies and Development

- *History and Development of television*
- *Television in India*
- *Development communication*
- *Agricultural communication and rural development*
- *Development support communication*
- *Rural development extension agencies*
- *Development in telecommunications*
- *Role of satellites and computers*
- *Mobile communication*
- *Satellite communication*
- *Information society-Information flows/barriers*
- *Right to Information*
- *Information technology and Globalization*
- *Knowledge society-Intellectual property rights, patents.*
- *India in the 21st century*

Media Research

- *Basics and concept of media research*
- *Nature of scientific enquiry*
- *Research process*
- *Aims and objectives*
- *Hypothesis*
- *Methods of data collection*
- *New paradigms of research*
- *The qualitative and quantitative research*
- *Applications of research in media industry*
- *The concept of research design*
- *Scientific writing*
- *Research issues in communication studies*
- *Types of research design*
- *Audience research*
- *Understanding mass audiences*
- *Measuring mass audiences*
- *Measurement tools and techniques for print media*
- *Use of internet in research*
- *Use of SPSS package*
- *Publishing research*
- *Effect research*
- *Advertising research*
- *Market and product research*

- *Conclusions and report writing*

Media, Culture and Ethics

- *Media ,culture, technology, economy, power and effects*
- *The functionalist and normative issues*
- *Media content and cultural production*
- *Cultural hegemony*
- *Media ethics*
- *Cyber laws*
- *Ethics for print and electronic media journalists*
- *Skills of news gathering and news broadcasting*
- *Code for commercial broadcasting*
- *Defamation*
- *Contempt of court*

Media planning and management

- *Media , Advertisers and consumers*
- *Analysis of markets and consumers*
- *The media mix*
- *Selection of media vehicles*
- *Tools and techniques of media planning*
- *Principles of media management*
- *Organizational behaviour*
- *Human resource development*
- *Motivation incentives*
- *Characteristics of different media*
- *Creativity and management of creativity*

Reading Film

- *Fundamentals and history of cinema*
- *Knowledge, culture and political economy*
- *Pre and Post production*
- *Media effects-film, TV and Radio*
- *Basic planning and procedures in video production*
- *Visual thinking*
- *Fiction and Non- fiction formats*
- *Creative processes*
- *Space, time and design*
- *Research related to video production*
- *Script writing in video production*
- *Screen play Actual writing and the craft of re-writing*

Public relations and Advertising

- *Marketing environment in India*
- *Basics and Changing nature of public relations*
- *Concept of corporate communication*
- *In –house communication*
- *Planning and conceptualization of seminars and exhibitions*
- *Employee perception*
- *Advertisements and social images*
- *Nature of advertising language*
- *Role of ABC,NRS,TRP in process of advertising*

Model Question Paper for PhD Entrance Exam
Paper II: Communication Studies

This paper is of 100 marks containing two sections. Candidates are required to attempt the questions, following the instructions of each section.

Time : 2 Hours **Total marks: 100**

Section –I

Note: **This section contains 20 multiple choice questions. Answer all questions. Each carries 1 mark.**

Sample Questions

1. *Length of a communication is barrier to ( )*
a. reception b. acceptance
c. transmission d. understanding

2. *The first television channel to adopt all news radio formats is ( )*
a. CNN b. ABC
c. ABC d. CBS

3*. Which of these is not a method of data collection. ( )*
a. Questionnaires b. Interviews
c. Experiments d. Observations

4. *Which research paradigm is least concerned about generalizing its findings( )*
a. quantitative research b. qualitative research
c. mixed research d. none of the above

***5**. Which one of the following is a mismatch ( )*
a. POGO- fashion channel b. ESPN- sports channel
c. NDTV-news channel d. HBO- movie channel

Section –II

Note: * Q.1 is compulsory
**** Attempt any six from the remaining questions***
**** Answers should be precise and to the point***

Sample Questions

1. *Prepare a well-framed concise research design of your interest area applying all steps of research process. Clearly state the boundaries of your research and hypothesis with respect to the research design in a short introductory paragraph before you begin with the research design.*
   (20 marks)

2. *Discuss in detail the qualitative methods of data collection(10 marks)*

3. *What is development? Explain the role of communication in the development process (10 marks)*

4. *Prepare a structured questionnaire for interviewing the social activist Ms.Medha patkar (10 marks)*

5. *Design a advertising campaign for any social message of your interest (10 marks)*

ECONOMICS

SYLLABUS AND FORMAT FOR PH.D ENTRANCE EXAMINATION PAPER-II

I Microeconomics Analysis

Demand Analysis –

Cardinal Utility Approach - Law of Diminishing Marginal Utility , Consumer's equilibrium, Derivation of Demand Curve, Law of Demand.
Ordinal Utility Approach:- Indifference curve, Properties Consumer's equilibrium, Price, income & substitution effects, Derivation of Demand Curve.
Revealed Preference Theory of Demand.
Recent Development in Demand Theory :- Hicksian Revised Theory – Neumann – Morgenstern Statistical Utility Theory, Armstrong's Marginal Preference Theory .

Consumer Surplus and Elasticity of Demand:-

Consumer Surplus: - Meaning, Marshall's Measurement of Consumer Surplus, Measurement of Consumer Surplus through indifference Curve analysis
Elasticity of Demand :- Meaning, Price Elasticity of Demand, Measurement of Price elasticity, Income Elasticity of Demand, Cross Elasticity of Demand, Numerical Problems .

Theory of Production:

Supply Analysis: Economies of Scale: - Internal Economies and Diseconomies, External Economies and Diseconomies.
Production Possibility Curve.
Production Function :- Law of Variable Proportions
Returns to Scale.
Isoquants:- Properties , Producer's equilibrium
Linear Homogenous Production Function
Cobb - Douglas Production Function.

Cost and Revenue

Cost Concepts: - Accounting and Economic Cost, Private Cost and Social Cost, Opportunity Cost, Fixed and Variable Cost, Average, Marginal and Total Cost, Numerical Problems.
Short Run and Long Run Cost Curves
Revenue Concepts: - Average, Marginal and Total Revenue, Numerical Problems.

Price & output Determination (A) -

Perfect Competition - Features, Price Determination, Equilibrium of the Firm and Industry.
Monopoly: - Price and Output Determination.
Comparison between Monopoly equilibrium in and perfect Competiton

Equilibrium Discriminating Monopoly – Price Discrimination, Equilibrium under Discriminating Monopoly.
Regulation of Monopoly – Through Taxation, and Price Regulation

Price & output Determination (B) -

Monopolistic Competition – Price and Output Determination.
Critique of Chamberlin's Theory of Monopolistic Competition
Excess Capacity under Monopolistic Competition
Selling Cost.
Oligopoly – Price and Output Determination.
Cournot's Model and Chamberlin's Model of Oligopoly.
Kinked Demand Curve in Oligopoly. Game Theory of Oligopoly.
Duopoly – Price and Output Determination.

Alternative Theories of the Firm –

Baumol's Model of Sales Revenue Maximization.
Marris's Managerial Model of the Firm.
Williamson's Managerial Model of the Firm.

Factor Pricing –

Marginal Productivity Theory.
Euler's Theorem and Product Exhaustion Problem or Adding up Problem.
Modern Theory of Rent.
Wage Determination under Collective Bargaining.
Fixation of Minimum Wage.
Modern Theory of Interest, IS-LM Curve Model.
Dynamic Theory of Profit, Innovation Theory, Risk and Uncertainty Theory.

Welfare Economics.

Pigou's Theory of Welfare Economics
Conditions of Pareto Optimality.
Bergson – Samulson's Social Welfare Function.
Arrow's Impossibility Theorem.

II. Public Finance

The Role of the Government in a Changing Perspective
Fiscal Functions of the Government.
Co-ordination among these Functions.
Provision of Private Goods, Public Goods, Social Goods, Merit Goods and Mixed Goods.

Principles of Taxation –

Principle of Fiscal Neutrality, Excess Burden, Doctrine Principle of Equity, Benefit Principle, Bowen and Lindhal Models, Ability to pay Principle Administrative Efficiency .Application of Taxation Principles in Developing Countries.
Meaning, Types and Measurement of Taxable Capacity.

Impact and Incidence of Taxes

Meaning of Impact and Incidence
Distinction Between Impact and Incidence
Types of Incidence

Theories of Shifting Incidence
Shifting of Tax Incidence under Different Market Conditions.

Public Expenditure

Wagner's Law
Wiseman – Peacock Hypothesis
Pure Theory of Public Expenditure
Social Cost- Benefit Analysis

Public Debt.

Classical, Keynesian and Post – Keynesian Approaches of Public Debt.
Classification of Public Debt.
Burden of Public Debt.
Public Debt Management
Repayment of Public Debt.

III. Indian Public Finance

Government Budgeting -

Budget – Meaning and Components.
Preparation, Presentation and Execution of Budget.
Economic Classification of Budget
Budget Deficits and Their Implications.

Revenue, Expenditure and Public Debt.-

Trends in Revenues of Union , State and Local Bodies since 1991.
Trends in Expenditure of Union , State and Local Bodies since 1991.
Burden of Public Debt on Indian Economy
Public Debt Policy since 1991.
Reforms in Direct and Indirect Taxes

Deficit Financing -

Meaning and Objectives of Deficit Financing.
Trends in Different Types of Deficits Since 1991.
Deficit Financing in India.
Effects of Deficit Financing on Indian Economy.
Assessment of the Recent Central Government Budget.

Fiscal Policy –

Meaning and Objectives.
Interdependence of Monetary and Fiscal Policies.
Automatic Vs Discretionary Stabilizers.
Balanced Budget, Multiplier & Crowing Out Effects.
Indian Fiscal Policy since 1991.
Indian Fiscal Imbalance - Indicators, Causes, Effects & Remedial Measures.

Federal Finance.

Principles of Federal Finance.
Assignment of Functions & Devolution of Resources and Grants.
Vertical and Horizontal Imbalance.
Transfer of Resources from Union to States.
Recommendations of Eleventh and Twelfth Finance Commissions.
Centre – States conflicts on Finances

IV. Macro Economic Analysis

National Income and Accounts :
Key concepts in Macro Economics, Circular flow of income: two three and four sector economy – different forms of national income accounting, flow of funds accounting and balance of payment accounting, Social Accounting

Consumption Function
Keynes Psychological law of consumption – Implications of the law of consumption– short run and long run consumption function ; Empirical evidence of consumption function, Income consumption relationship – absolute income, relative income, life cycle and permanent income hypothesis.

Investment Function
Marginal efficiency of capital and investment — long run and short run; Investment Multiplier, The accelerator and investment behavior.

Supply of Money
Financial intermediation — a mechanistic model of bank deposit determination; A behavioral model of money supply determination, a demand determined money supply process; RBI approach to money supply; High powered money and money multiplier; budget deficits and money supply;

Demand for Money
Classical approach to demand for money, Quantity theory approach, Fisher's equation, Cambridge quantity theory, Keynes's liquidity preference approach, transaction, precautionary and speculative demand for money, Liquidity trap —aggregate demand for money; Derivation of LM curve.

Controversy in Macro Economics: Classical, neo classical, Keynesian and post Keynesian.

Neo-classical and Keynesian Synthesis
Neo-classical and Keynesian views on interest; The IS-LM model; Extension of IS-LM model with government sector; Relative effectiveness of monetary and fiscal policies; Extension of IS-LM models with labor market and flexible prices.

Post-Keynesian Demand For Money
Post-Keynesian approaches to demand for money — Patinkin and the Real Balance Effect, Approaches of Baumol and Tobin; Friedman and the modern quantity theory; Crisis in Keynesian economics and the revival of monetarism.

Theory of Inflation
Classical, Keynesian and Monetarist approaches to inflation; Structuralist theory of inflation; Philips curve analysis — Short run and long run Philips curve; Samuelson and Solow — the natural rate of unemployment hypothesis; Tobin's modified Philips curve; Policies to control inflation.

Business Cycles

Theories of Schumpeter, Keyne's, Kaldor, Samuelson and Hicks, Goodwin's model; Control of Business Cycles — relative efficacy of monetary and fiscal policies.

V. Economics of Growth and Development

Classical theories of Growth

Contributions of Adam Smith, Ricardo, Malthus, James Mill; Karl Marx and development of capitalistic economy — Theory of social change, surplus value and profit; Immutable laws of capitalist development; Crisis in capitalism — Schumpeter and capitalistic development; innovation — role of credit, profit and degeneration of capitalism; Structural analysis of development; Imperfect market paradigm.

Growth Models - I

Harrod and Domar, instability of equilibrium; Neo-classical growth models — Solow and Meade, Mrs. Joan Robinson's growth model; Cambridge criticism of Neoclassical analysis of growth, The capital controversy.

Growth Models - II

Technological progress — embodied and disembodied technical progress; Hicks,Harrod; learning by doing, production function approach to the economic growth;Total factor productivity and growth accounting; Growth models of Kaldor and Pasinetti, Optimal savings and Ramsay's rule, Golden rule of accumulation, Stability of equilibrium; Money in economic growth, Tobin, Levhari, Patinkin and

Johnson; Endogenous growth; Intellectual capital: role of learning, education and research; AK model — Explanations of cross country differentials in economicgrowth.

Social and Institutional Aspects of Growth

Perpetuation of underdevelopment; Poverty — Absolute and relative; Quality of life- Food security, education, health and nutrition; Human resource development; Population problem and growth pattern of population- Theory of demographic transition; Population as limits to growth as ultimate source

Approaches to Development

Partial theories of growth and development — vicious circle of poverty, circular causation, unlimited supply of labour, big push, balanced growth, unbalanced growth, critical minimum effort thesis, low-income equilibrium trap; Dualism —technical, behavioral and social; Ranis and Fei model; Dixit and Marglin model,Kelly et. al. Model; Dependency theory of development; Structural view of development.

Sectoral Aspects of Development

Role of agriculture in economic development; Efficiency and productivity in agriculture, New technology and sustainable agriculture; Globalization and agricultural growth; Rationale and pattern of industrialization in developing countries; The choice of techniques and appropriate technology and employment; Efficiency of small-scale vs. large-scale production; Terms of trade betweenagriculture and industry;

Infrastructure and its importance; Labour markets and their functioning in developing countries.

Trade and Economic Development

International trade as engine of growth; Static and dynamic gains from trade; Prebisch, Singer and Myrdal theories vs. free trade; Export-led growth; Dual gap analysis.

Macroeconomic Policies and Development

Role of monetary and fiscal policies in developing countries — Prior savings, inflation and growth — Empirical evidence; External resources — FDI, aid vs. trade, technology inflow; MNC activity in developing countries; Borrowings — domestic and external; Burden of borrowing

VI. International Economics

Theories of International Trade

Comparative Cost advantage, Heckscher-Ohlin theory of trade and Neo Heckcher-Ohlin theorem. Kravis, Samuelson's Factor Price Equalization Theory, Linder theory of trade. Leontief paradox, Stoper-Samuelson's theorem, New Theories of Intra- industry trade and economies of Scale.

Terms of trade and Determination of Exchange Rate

Concept and types of terms of trade. Terms of trade and Less developed countries.

Theories of exchange rate determination, Fixed and Flexible Exchange control –meaning objectives & methods of exchange control. Meaning types and effects of tariffs and Non-tariff barriers.

Balance of Payments

Meaning and components of balance of payments; Theories of balance of payments, Equilibrium and disequilibrium in the balance of payments.

Trade policies in India

Recent changes in the direction and composition of trade and their implications. Instruments of export promotion, Recent import and export policies.

International Financial Movements

International trade and financial institutions – IMF, World Bank & WTO. Foreign investment and their impact on the Indian Economy. Role of Multinational corporation.

VII. Statistical Techniques

Descriptive Statistics

Collection, Organization and Presentation of Data.

Measures of central tendency and dispersion- mean, median, mode, standard
deviation, variance, covariance and correlation coefficients.

Correlation and regression analysis.

Measures of skewness and peaked ness.

Sampling and sampling methods

Sample and Population, Parameters and Statistics.

Variables and Attributes; sampling and non-sampling errors;

Types of sampling

Theory of Probability

Probability, distribution, Events spaces.

Joint, Marginal and Conditional Probability under conditions of certainty and uncertainty. Random variable: Expectation and Distribution. Addition and Multiplication Theorems.

Probability Distribution, discrete and continuous and Expected values.

Probability Distribution Function

Binomial, Poisson,

Normal t-test, chi-square, t-test.

Statistical Estimation and Testing of Hypothesis

Types of estimators and their properties.

Sampling distribution for sample mean and Proportion.

Point and Interval estimation.

Null and Alternate Hypothesis.

Level of significance and Level of confidence, Confidence limits and Critical

Region;

Tests of significance- Type I and II errors.

Time series

Nature and decomposition of a time series-trend.

Cyclical, seasonal and random components.

Fitting trend curves.

Index numbers

Laspeyer's, Paasche's and Fisher's Indices

FORMAT OF THE PAPER

1. The paper will be for 2 hours.
2. The paper will be for 100 marks.
3. There will be objective questions for 20 marks. These will include 'multiple choice', 'match-the-following' and 'true-false' type of questions.
4. There will be subjective questions for 80 marks. The further breakup is as follows –
    a. For 40 marks there will be two 20 marks, essay type questions.
    b. For 40 marks there will be small to medium type questions. These will include Short notes, Justify, Answer in Brief etc.
5. There will be sufficient choice.

INTERDISCIPLINARY SCHOOL OF SCIENTIFIC COMPUTING

Syllabus for Ph.D. Entrance Examination

The paper will consists of three parts viz. objective questions for 20 makrs, descriptive questions for 60 marks and description of an open problem for 20 makrs.

Objective Questions : There will be 10 questions, 2 marks each, based on **Mathematical and Logical Ability**. They will not be multiple choice questions.

Descriptive Questions : There will be 6 questions, 10 marks each, on the following topics.

General Mathematics **:** Differential & Integral Calculus, Curve sketching, Linear Algebra, Vectors, Differential Equations.

Discrete Mathematics **:** Graph Theory, Permutations and Combinations, Boolean Algebra, Set Theory & Logic

Numerical Methods **:** Linear & Nonlinear equations, curve fitting & interpolations, Numerical Integrations, differentiation, Numerical solutions of Differential Equations

Computer fundamentals : Binary & hexadecimal representation, Data structures, searching & sorting algorithms

Programming Principles and Languages : C fundamentals , Fortran, Basics of

algorithms, Testing and debugging of codes/pseudocodes.

Statistics : Mean, mode, median, variance, standard deviation, Correlation, Probability.

Description of an open problem :

A candidate should describe any open problem in his/her subject of qualifying degree. He/she should pose a problem, formulate it as a research problem and describe how its solution can be attempted. The problem need not be the one which he/she wishes to pursue for doctoral degree. Awareness and approach is important.

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Instrumentation Science

Syllabus for Entrance Test (PhD)

Principles of operation, specification and construction of transducers Displacement transducers: Potentiometer, Capacitive, Inductive, Optical encoders – Linear and Rotary, Inductive, Tachometers. Level: Mechanical, Capacitive, Ultrasonic, Radioactive, Microwave, Conductive, Heat transfer Pressure: Bourdon Tube, Differential pressure measurement, Strain gauges, Inductive, Capacitive, Piezoelectric Transducers, Vacuum – Pirani and Penning gauges Flow: Differential Pressure type, Variable area type, Rotameters, Electromagnetic, Mass flow, Turbine, Anemometer, ultrasonic Temperature: RTD, Thermocouple, Thermisters, Semiconductor Sensors, Pyrometry Chemical sensors: Measurement of Conductivity, pH and Humidity,

Optical sensors: PMT, Photodiodes, CCD, LDR, Advanced sensors: Optical fiber sensors for temperature, image, displacement, pressure, flow, and liquid level sensors, biosensors and smart sensors

Actuators: Principles and applications of mechanical, electrical, hydraulic, pneumatic actuators, valves, relays, solenoids, annunciator, motorized valves, fluidic gates etc

Transducer Performance: Electrical tests, measurement units, measurement of voltage, current, frequency, impedance, noise, loading errors, resolution, threshold, calibration, dynamic, environmental and life test.

Analog signal conditioning:

Basics of operational amplifier, ideal and practical characteristics, specifications, data sheet referencing, Input and output impedances, offset voltage and current, bias current, slew rate, CMRR, gain-bandwidth product, concept of positive feedback and negative feedback, basic amplifier configurations and applications: inverting and non-inverting amplifier, summing amplifier, subtractor etc.

Single ended and differential signals, instrumentation amplifiers, precision rectifiers, active filters, Log - antilog amplifiers, peak detector, differentiator, integrator, Schmitt trigger wave shaping circuits, liberalization circuits, mili-volt to current converter, F to V and V to F conversion, phase lock loop etc. problems on analysis and designing, AC carrier systems, phase sensitive Modulator, Demodulator, Chopper stabilized Amplifier.

Analog to digital converters: Flash, Counter type, Tracking, Successive approximation, Single Slope and Dual slope ADC, Sigma Delta ADC, Study of typical ADC ICs, specifications, merits and demerits, Problems on analysis and designing. Digital to analog converters: Binary weighted and R – 2R type, specifications, merits and demerits, Applications of DACs like Programmable power supplies, waveform generation and synthesis, Study of typical DAC ICs Problems on analysis and designing.

Embedded systems and PC base instrumentation:-

Embedded Instrumentation: *Need and advantages of using Microprocessors in*

Instrumentation: Basic concepts of embedded instrumentation, features, specifications and differences; different blocks of embedded instruments, ideal microprocessor / microcontroller based Instrument, case study; Basics of processor / controller, hardware resources

Microprocessor support devices: *Memories:* interfacing of memory devices with microprocessor / microcontroller. Memory mapping scheme for microprocessor 8085, memory decoders, folded memory, external memory interfacing for microcontroller 8051, internal memory map for 8051, details of various SFR's and BIT addressable memory, *Input output devices:* I / O mapping, I / O mapped I / Os, Memory mapped I / Os, advantages and disadvantages, non programmable I / O devices, Programmable peripheral interface 8255, Programmable timer counter 8253, Keyboard and Display interface device 8279, study and interfacing techniques for 8051;

Modular development of embedded system: Interfacing of switches and LEDs, Rotary switches and related programming, interfacing of matrix type keyboard, lookup table searching, Error detection programs, Interfacing of seven segment displays and alpha numeric LCD modules, Interfacing of ADC and DAC, I / O Expansion for 8051 using serial interface, Timers and counters in 8051, various modes of operation, generation of PWM signal, Interrupts in 8051, priority of interrupts, vectored interrupts

Implementation and applications of serial interface RS 232 using 8051 UART, Study of Parallel Interface, extensive programming exercises using assembly and C language.

Power down and Idle mode of operation in 8051, Program securities

PC based Instrumentation: Need of PC based Instrumentation. Comparison between embedded instrumentation and PC based instrumentation

PC add on cards: Different bus architectures on PC motherboard for add on card / prototype functions i.e. PCI, PCI express bus, Control through PC add on card, Data acquisition concept by study of AD / DA card, Introduction to digital input output card, Timer card, Frame grabber card, Ethernet card

PC communication ports: Introduction to CENTRONICS parallel port, Serial COM1 /

COM2 ports, RS232 standard, USB communication, Importance of GPIB / IEEE488 interface for PC based instrumentation for scientific applications

Lab VIEW based Instrumentation: Introduction to Windows API, Introduction to Lab

VIEW, “G” language concept, Introduction to VI, Sample VI – making and execution on PC

Processes control and automation

Fundamentals of process control: Introduction to process control, open loop and closed loop systems, Process parameters, Control systems parameters, Different controller modes, Composite controllers

Discontinuous and continuous controllers: Study of On - off controller, Proportional controller, PI controller, PID controller, Study of electronic and pneumatic controllers, control loop characteristics, control system configuration, single variable, multi variable, cascade controllers, feedback and feed forward controller.

Discrete state process control: Discrete state system characteristics, process specifications, sequential control, Programmable Logic Controllers, Ladder diagrams, PLC programming and operation, Computer in process control, Data logging, Supervisory controllers, Factory automation

Optical instrumentation and photonics and Optical Fiber Communication

Introduction to Optical Systems in LASER: Properties of Laser, Basics of Laser principles: active medium, laser pumping, optical feedback, laser output: line shape broadening, laser modes: optical resonance, pump rate, power output

Optical Fiber: Introduction to Optical fiber, principle in optical fiber, numerical aperture, multimode and single mode fibers, losses in fiber: dispersion, absorption, scattering losses, types of couplers and connectors, losses due to couplers, splicing techniques, fabrication techniques, Applications of optical fiber viz. Fiber Optic sensors, Communication System etc

Reference Books:

1. Rangan, Mani, Sharma: Instrumentation devices and systems.
2. Nakara, Chaudhari: Instrumentation, Measurement and Analysis.
3. Gaikwad: Op-amps and linear ICS
4. G. B. Clayton: Operational amplifiers
5. Millman and Halkias: Integrated electronics
6. R. F. Coughline: Op-amps and linear ICs
7. Gaonkar: Microprocessor Architecture, programming and Applications.
8. K. J. Ayala: The 8051 Microcontroller
9. C. D. Johnson: Process control Instrumentation Technology.
10. K. Ogata: Modern Control Engineering
11. Jenkins and White: Optics
12. R. Sirohi, M. P. Kothiyal: Optical Components, Systems and Measurement techniques
13. IBM PC and Clones – B. Govindarajalu

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Medical Faculty

Syllabus for Paper II for Ph.D. entrance examination

Ph.D. (General Medicine)

Cardiovascular system, Haemopoetic System, Collagen Diseases and Rheumatology, recent Advances.

Respiratory System including Tuberculosis, Renal Diseases, Therapeutics, Paediatrics, Genetics.

Gastro-intestinal System including Hepatobiliary System, Metabolic Diseases, Endocrine Nutritional Disorders.

Central Nervous System, Infections and Tropical Diseases, Psychiatry, Dermatology.

Ph.D. (Obstetrics and Gynaecology)

Obstetrics including the diseases of the New born.

Gynaecology, Gynaecological Pathology and Operative Gynaecology.

Medical and Surgical Diseases, Complicating Obstetrics and Gynaecology. Social Obstetrics and Gynaecology including Maternal Child Health and Family Planning and Recent Advances.

Ph.D. (Pathology)

General pathology including Recent Advances.

Systematic Pathology including Recent Advances.

Clinical Microbiology, Clinical Pathology, Virology Chemical Pathology, including Recent Advances.

Haematology, Blood Transfusion, Virology, Immunohaematology and Recent Advances.

Ph.D. (Microbiology)

General microbiology, including Recent Advances Clinical Pathology, Principles of General Pathology.

Bacteriology including Recent Advances.

Immunology and Parasitology including Recent Advances.

Virology and Mycology including Recent Advances.

Ph.D. (Pharmacology)

Experimental Aspects of Pharmacology and Toxicology.

Theoretical Aspects of Pharmacology and Toxicology.

Applied Pharmacology.

Recent Advances in Pharmacology and Toxicology.

Ph.D. (Preventive and Social Medicine)

Theory and Practice of Preventive and social Medicine (including Social Science, Health Education, Genetics, Public Health Administration, Administration including Medical / Health Care Maternal and Child Health Rehabilitation, Public Health Chemistry etc.)

Theory and Practice of Preventive and Social Medicine (including Biostatistics, Epidemiological Techniques, Research Methodology, Vital Statistics, demographic Techniques, Nutrition etc.)

Theory and Practice of Preventive and Social Medicine (including Environmental Health, Occupational health including Industrial Toxicology and Occupational Physiology, Parasitology, Entomology, Public Health Laboratory Practice.)

Theory and Practice of Preventive and Social Medicine (including General Medicine) applied to the Field of Public Health (Communicable and Non-communicable Diseases, etc.)

Ph.D. (Paediatrics)

Basic Science, Anatomy, Physiology, Pathology, Pharmacology as related to Paediatrics, Neonatology and Developmental Paediatrics, including adolescence medicine.

Diseases of Cardiovascular, Respiratory Gastro-Intestinal Systems, Urogenic Systems, infectious diseases.

Diseases of Nervous Haematologic Systems, Oncology, immunology, Endocrine Metabolic Genetic Diseases.

Preventive and Social Paediatrics, Paediatric Psychiatric, Dermatological, Ophthalmic ENT and Miscellaneous Disease Paediatric Surgery and Recent Advances, Paediatrics, Nutrition.

Ph.D. (Radio-Diagnosis)

Applied Basic Sciences including Radiological as applicable to Radio Diagnosis.

Radio Diagnosis including Radiographic Techniques.

Radio Diagnosis including Recent Advances in Radio Diagnosis.

General Medicine and General Surgery as applicable to Radio-Diagnosis.

Ph.D. (Anaesthesiology)

Basic Sciences as applied in Anaesthesiology.

Anaesthesiology including Techniques.

Anaesthesiology including Recent Advances.

Medicine and Surgery as applied to Anaesthesiology.

Ph.D. (Tuberculosis and Respiratory Diseases)

Basic Sciences (Applied Anatomy, Physiology, Pharmacology, Bacteriology and Pathology as related to Tuberculosis and Respiratory Diseases.

Tuberculosis (Respiratory) and Extra Pulmonary Tuberculosis.

Non-Tubercular Respiratory Diseases.

General and Thoracic Surgery and General Medicine and related to Respiratory Diseases and Recent advances, including critical case.

Ph.D. (Physiology)

General and Cellular Physiology, Applied Bio-chemistry, Bio-physics and Bio-statistics.

Advanced Systemic Physiology All systems including exercise physiology and v nutrition. History of Physiology, Comparative Physiology, Applied Physiology.

Recent Advances in Physiology.

Ph.D. (Psychiatry)

Neurology, Neuroanatomy, Neurophysiology and General Medicine, Viz. Endocrinology, Toxicology and Genetics

General and Child Psychology including Statistic, Psycho-Physiology, Psycho-Pathology, Psycho-diagnostics, etc. and Social, Preventive and Forensic Psychiatry.

Psychiatric Disorders (Adult) and their treatment.

Child and Adolescence Psychiatry, Recent Advance in Psychiatry.

Ph.D. (Dermatology, Venereology and Leprosy)

Applied Basic Science in relation to Dermatology Venereology and Leprosy.

Skin Diseases including Therapy and Skin Surgery.

Venereology and Leprosy.

Internal Medicine as related to Dermatology, Venereology and Leprosy.

Ph.D. (Biochemistry)

General Biochemistry, Physical Chemistry, Cell and Biophysics, Biostatistics.

Metabolism and Nutrition.

Medical Biochemistry, Metabolism and Genetics.

Molecular Basis of Human Diseases, Recent Advances in Biochemistry, Biotechnology.

Ph.D. (Hospital Administration)

General Administration and Management in Hospital.

Health Administration and Medical Care.

Hospital Administration and Hospital Planning.

Administration of Clinical and Non-clinical service and Administration Problems.

Ph.D. (Forensic Medicine)

Basic Science as related to Forensic Medicine and Toxicology.

Forensic Psychiatry, Medical Jurisprudences, Forensic Sciences.

Forensic Medicine.

Toxicology, Recent advances in Forensic Medicine and Toxicology.

Ph.D. (Physical Medicine and Rehabilitation)

Basic Medical Sciences and Applied to Physical Medicine and Rehabilitation.

Principles and Practice of Physical Medicine and Rehabilitation.

Principles and Practice of Physical Medicine and Rehabilitation.

Orthopaedics, Surgery and medicine as applied to Physical Medicine and Rehabilitation.

Ph.D. (Medical Genetics)

Basic Sciences as applied to Medical Genetics.

Principles and Practice of Medical Genetics.

Principles and Practice of Medical Genetics.

Applied Medical Genetics and Recent Advances.

Ph.D. (Accident and Emergency Medicine)

Physiology, Pathology and Pharmacology as applied to emergency medicine.

Cardiorespiratory and medical emergencies.

Surgical emergencies including trauma.

Obstetrics, Ophthalmic, Toxicological and other emergencies.

Ph.D. (General Surgery)

Basic Medical Sciences as related to General Surgery.

General Surgery.

General Surgery.

E.N.T. Obstetrics and Gynaecology, Orthopaedics, Opthalmology, Neurosurgery, Cardio-vascular Surgery as related to General Surgery and Recent Advances in General Surgery.

Ph.D. (E.N.T.)

Basic Sciences including Pharmacology in relation to E.N.T.

Disease of Ear.

Diseases of Nose and Paranasal Sinuses.

Diseases of Throat including Oesophagus and Trachaobronchial Tree and Recent Advances in E.N.T.

Ph.D. (Ophthalmology)

Basic Science as related to Ophthalmology.

Ophthalmic Medicine and Surgery.
Ophthalmic Medicine and Surgery.

Ophthalmology as related to Surgery, Dentistry E.N.T. and Recent Advances in Ophthalmology.

Ph.D. (Orthopaedics)

Applied Basic Science as applied to Orthopaedics.

Orthopaedics including Operative Surgery Fracture and Joint Injury.

Orthopaedics as related to General Surgery and Rehabilitation and Recent Advances in Orthopaedics.

Ph.D. (Anatomy)

Human Gross Anatomy.

Human Anatomy including Histology

Embryology and History of Anatomy.

Nemoanatomy, Genetics and Physical Anthropology.

Applied Anatomy.

Recent Advances in Anatomy.

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पी.एच. डी. प्रवेश परीक्षा अभ्यासक्रम

संगीत – गायन

१ भारतीय संगीताचा प्राचीन, मध्ययुगीन व अर्वाचीन इतिहास

२ संगीत व विज्ञान – श्रुती – स्वर शास्त्रविचार, ध्वनिशास्त्र

३ सौंदर्यशास्त्र – प्राचीन ते अर्वाचीन सौंदर्यविषयक विचार

४ संशोधन पद्धती

५ संगीत अध्यापन पद्धती

६ कलांचे सादरीकरण

७ भारतातील विविध संगीतपद्धती – उदा. रविंद्र संगीत, कर्नाटक संगीत वगैरे

८ संगीत, गायक, कलाकार, वादक, वाग्गेयकार, शास्त्रकार यांचे योगदान

९ संगीतातील विविध गायनप्रकार – शास्त्रीय, उपशास्त्रीय, लोकसंगीत

संगीत – तबला व पखावज (अवनद्ध वाद्य)

१ अवनद्ध वाद्य (विशेषतः तबला/पखावज) – उगम आणि विकास

२ भारतीय अवनद्ध वाद्यांचा इतिहास

३ प्राचीन ग्रंथांमधील 'ताल' या संज्ञेचा विस्तृत अभ्यास

४ ध्वनीचा वैज्ञानिक अभ्यास

५ तबला/पखावज बनावट, बनावटीच्या दृष्टीकोनातून तबल्याची इतर चर्मवाद्यांबरोबर तुलना

६ ताल व ठेका विस्तृत अध्ययन

७ स्वतंत्र तबला/पखावज वादनातील सर्व संकल्पनांचा सखोल अभ्यास

८ तबला/पखावजमधील भाषेचा उगम आणि विकास

९ तबला/पखावजमधील सर्व घराणी व त्यांच्यामधील सौंदर्यतत्त्वे

१० साथसंगतीचे एक प्रमुख वाद्य म्हणून तबल्याचे भारतीय संगीतातील स्थान

११ तबला/पखावजच्या भाषेचा छंद व वृत्तांशी असलेला संबंध

१२ तबल्यातील लयसौंदर्य, जातिसौंदर्य, गणितसौंदर्य व भाषा सौंदर्य

१३ पं. भातखंडे व पं. पलुस्कर या तालिपींव्यतिरिक्त नवीन तालिपींच्या निर्मितीची शक्यता

१४ त्रितालेतर तालातील स्वतंत्रवादन (विशेषतः विषम ताल)

संगीत – स्वर वाद्य (तंत व सुषीर वाद्य)

* इतिहास
  - १) वाद्ये – उद्‌गम, विकास
  - २) प्राचीन ग्रंथांतील वाद्याध्यायांचा अभ्यास (प्रामुख्याने नाट्यशास्त्र, रत्नाकर)

* वाद्यांचे शास्त्र
  - १) वाद्यांच्या ध्वनिनिर्मितीचा वैज्ञानिक अभ्यास, वाद्यांचे acoustics ध्वनिशास्त्र
  - २) वाद्यांची बनावट, raw material etc. संदर्भातील भौतिकशास्त्र

* सैद्धांतिक विचार
  - १) रागविचार – 'राग' संकल्पना, रागवर्गीकरण, श्रुतिशास्त्र, बंदिश – प्रकार
  - २) वाद्यांतील वादनविधी – गतकारी, प्रकार, घराणी – सौंदर्यतत्त्वे व नियम, वादनक्रियांचे
    प्रकार – आलाप, जोड, झाला इ.
  - ३) स्वरलेखन/लिपी
  - ४) वृंदवादन, उपयोजित संगीत
  - ५) महत्त्वाचे वादक, गुरु, शास्त्रकार, वृंद संयोजन

* संशोधनप्रणाली व नवे प्रवाह
  - १) संस्कृती संगीतशास्त्र, लोकसंगीतशास्त्र
  - २) संगीत व समाजशास्त्र, मानसशास्त्र, नवीन तंत्रज्ञान व माध्यमे
  - ३) संगीतविषयक लेखन, समीक्षा
  - ४) वाद्ययंत्र शास्त्र (Organology)

नृत्य

1. History of Dance

A. Ancient, medieval and modern history of Indian Classical Dances.

B. Study of ancient texts : Natya Shastra, Sangeet Ratnakar, Abhinaya Darpana, Abhinava Bharati.

2. Science of Dance

A. Anatomy : Anga-s, Pratyanga-s, Upanga-s and their application in respective dance styles.

B. Iconography and painting : Basic principles common to dance.

C. Application to modern technology : Audio-visual devices, computers, internet, etc.

3. Aesthetics of Dance

A. Rasa theory of Bharata, Abhinava Gupta, Bhoja and others.

B. Information about modern aestheticians.

C. Comparative study of Indian and Western aestheticians

4. Religion and philosophy

A. Hindu definition of philosophy

B. Dance as a medium of worship

C. Various forms of Bhakti and Madhura Bhakti and its expressions through dance.

D. Study of spiritual and symbolic aspect of dance.

5. Various Indian Dance Systems :

A. Established classical dance styles : Four main, three sister styles of Bharata Natyam, Sattriya and Chau

B. Dance drama traditions in classical and folk

C. Technique and presentation repertoire of all systems mentioned above

D. Useful physical training systems like Yoga, Kalaripayattu, etc.

E. Contribution of prominent dancers and theoreticians : Eg. Birju Maharaj, Kelucharan Mohapatra, Rukmini Devi Arundale, Bharat Iyer, Vallathol, Bipin Singh, Anand Kumaraswami, V. Raghavan, Kapila Vatsyayan and others.

F. Difference between Classical, folk and other dance systems.

6. Dance Pedagogy :

A. Guru Shishya Parampara : Its significance, changing face and relevance in modern tiems.

B. Basic principles of teaching

C. Theraputic application of dance

D. Different objectives of teaching and learning in modern times.

7. Research methodology of dance.

8. Modern trends in dance : Western and Indian

नाट्य

१ मराठी रंगभूमी इतिहास १८४३ ते २०००

२ जागतिक रंगभूमी परिचय – ग्रीक रंगभूमी ते ग्रोटॉव्हस्की, पीटर ब्रूक

३ नाट्यशास्त्र तोंडओळख

४ मराठी रंगभूमी सद्यस्थिती आणि अर्थकारण

५ भारतीय नाटककार – विजय तेंडूलकर, बादल सरकार, गिरीश कर्नाड, महेश एलकुंचवार, सतीश आळेकर, गो. पु. देशपांडे, दत्ता भगत, संजय पवार, शफाअतखान आदि.

६ महाराष्ट्र लोकरंगभूमी परिचय – तमाशा, गोंधळ, दशावतार

७ नाट्य अभिनय संकल्पना संदर्भ : नाट्यशास्त्र, स्तानिस्लावस्की, मेयर होल्ड, आर्तो, ग्रोटाव्हस्की, रतन थियाम

८ नाटकाचा प्रयोग विचार : संहिता अर्थ निर्णय, दिग्दर्शन, अभिनय, नेपथ्य, प्रकाशयोजना, वेशभूषा, रंगभूषा

९ नाटक आणि अवकाश : विविध पद्धतीची नाट्यगृहे, नाट्य अवकाश, परिसर आणि नाटक ह्यांचा संबंध

१० नाटक आणि अन्य कला यांचा संबंध : संगीत, नृत्य, चित्रकला, चित्रपट

११ नाटकाचा साहित्यविचार आणि परीक्षण

१२ नाट्य संशोधन पद्धती : संशोधन म्हणजे काय?, संशोधन–योजन म्हणजे काय?, संशोधनाच्या पद्धती–ऐतिहासिक, वाचनालय, मुलाखत, प्रयोग, वर्णनात्मक (परीक्षण, मूल्यमापन, संशोधन.) शोधनिबंधाच्या विषयाची निवड, विषयामागचा अभ्युपगम – विधान – सिद्ध/असिद्ध, संशोधन–विषयाचे नेमकेपण, शोधनिबंधाचे शीर्षक, शोधनिबंध लेखन–पद्धती – शास्त्रीय पद्धत, भाषा, अर्थनिर्णयन, तपासणी साधने – प्रश्नावली, प्रारूपे : भाषिक/निर्भाषिक, व्ही.सी.डी., सी.डी., कॅसेट्स, टेप्स, दृक्–श्राव्य साधने, पुस्तके, लिखित सामग्री आणि साहित्य, आलेख, तौलनिक विश्लेषण संगणक सामग्री–विश्लेषण (प्रयोग–पद्धती फक्त), निष्कर्ष

१३ नाटकाचे अर्थकारण

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SOCIAL WORK

SYLLABUS OF PhD ENTRANCE EXAMINATION –PAPER-II

(w.e.f. January 2010 as per Revised Rules for Ph. D. Circular No./406/2009)

Note:

The syllabus consists of broad areas of Professional Social Work, which is indicative and non-exhaustive. For PhD entrance examination candidates are expected to prepare the basic courses of MSW / MA Social Work Curriculum.

The nature of Paper- II (Social Work): Subject specific test, Total 100 Marks, 20 marks objective type multiple choice questions and 80 mark theoretical descriptive questions.

1. Professional Social Work: History and Philosophy of Professional Social Work.
2. Professional Social Work: Concept, Characteristics, Principles, Values, Profession, and various approaches.
3. Social Work Methods, Practice and Interventions: Case Work, Group Work, Community Organization, Social Action, Social Welfare Administration, Social Work Research.
4. Fields of Social Work: Family and Child Welfare, Medical Psychiatric Social Work, Human Recourse Management / Labour Welfare and Personnel Management and Industrial Relations, Criminology and Correctional Administration.
5. Changing perspective, issues and challenges before Professional Social Work and Social Work practice.
6. Social Policy and Programmes. Government and Non Government initiatives.
7. Social Development, Social Work & Social Development, Social and Human Development issues and approaches.
8. Social Welfare, Social Justice, Social legislations, Social Welfare Organizations, NGO/ Non Profit Organization management.
9. Social Science Research, Social Work Research: Concept, scientific approach, essential elements, characteristics, research methodology, research stages and process, types of research, tool and techniques, statistics, statistical tools in research, computer embedded systems and programmes, various other issues, changing perspective and challenges.
10. Ability to prepare a scientific research proposal would be assessed.

German

Entrance Test Ph.D.
Syllabus for Ph.D. Entrance Test Paper II in German
Approved by the BoS German on 29.09.09 recommended and forwarded to the University Authorities

A. Entrance Test for Ph.D. course German

1. The areas of study:
   - **a.** Literature in German, Literary Criticism and History of Literature
   - **b.** Translation, Translation Theories and Linguistics
   - **c.** Didactics of German as a foreign Language, Didactics of Literature

   The objective and descriptive questions be asked on these areas.
2. **Pattern for the question paper** of the entrance test of Ph.D. in German and distribution of the marks as given under:

   General Pattern: Total marks 100, Distribution: 80 marks :descriptive answers 20 marks: objective questions

   There will be three (3) sections concerning the areas mentioned above and the candidate has to attempt questions of any two sections of her/his choice.Each Section will have 50 marks (40 descriptive and 10 objective questions)

   Section I: Literature in German, Literary Criticism, History of Literarure (50 marks)

   Section II: Translation, Linguistics

   Section III: Didactics of German as a foreign Language, Didatics of Literature

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University of Pune

Department of Urdu

Ph.D. Entrance Examination

Duration : Three Hours

Total Marks : 100

N.B. (1) All Questions are Compulsary. (2) Figures to the left indicates full marks .

سوال نمبر ۱:۔ ذیل کی معروضی (Objective) سوالات کے جوابات لکھئے۔ (۲۰)

۱۔ لفظ تحقیق کس زبان سے مشتق ہے؟ (اُردو، فارسی، عربی)

۲۔ تحقیق کی دو قسموں کے نام بتائیے؟ (خالص یا نظریاتی تحقیق، عملی تحقیق، اطلاقی تحقیق، علمی تحقیق)

۳۔ Synophsis کے معنی لکھئے۔ (ایک ساتھ دیکھنا، علیحدہ کرنا، علیحدہ کرکے دیکھنا، جزو کر دیکھنا)

۴۔ اُردو میں جعلی کتاب کے مشہور نمائندے ہیں۔ (قاضی عبدالودود، امتیاز علی خاں عرشی، عبدالحق، خواجہ عبدالرؤف عشر)

۵۔ تحقیق کا اہم وصف کیا ہے۔ (ضدی، ضعیف الاعتقاد، نامعلوم کو معلوم کرنے کی کرید)

۶۔ مرزا محمد فطرت نے کس مذہبی کتاب کا ترجمہ کیا؟ (قرآن مجید، مہابھارت، انجیل، توریت)

۷۔ ترقی پسند تحریک کا زوال کس ادبی تحریک کے فروغ کا باعث بنا؟ (علیگڑھ تحریک، جدیدیت، مابعد جدیدیت، رومانی)

۸۔ داستان کی اولین شرط کون سی ہے۔؟ (اختصار، منظر نگاری، مرقع نگاری)

۹۔ فسانہ عجائب کس کے جواب میں لکھی گئی؟ (طلسم ہوشربا، داستان امیر حمزہ، باغ و بہار، حاتم طائی)

۱۰۔ باغ و بہار کب مکمل ہوئی؟ (۱۸۰۰، ۱۸۰۲، ۱۸۰۵، ۱۸۰۷)

۱۱۔ منٹو کا سنہ وفات۔ (۱۹۵۰، ۱۹۵۱، ۱۹۵۵، ۱۹۶۰)

۱۲۔ کرشن چندر کے فن پر کس ادبی نظریہ کے اثرات نمایاں ہے؟ (اشتراکی نظریہ، جدیدیت، نفسیاتی نظریہ، رومانی نظریہ)

۱۳۔ اکبر الہ آبادی نے اپنے کلام میں کس ادبی تحریک کو نشانہ بنایا ہے؟ (ترقی پسند تحریک، علی گڑھ تحریک، جدیدیت، مابعد جدیدیت)

۱۴۔ سب رس کی دریافت کا سہرا کس کے سر ہے؟ (نصیر الدین ہاشمی، قاضی عبدالودود، مولوی عبدالحق، امتیاز علی عرشی)

۱۵۔ قطب مشتری کے خالق کون ہے؟ (غواصی، نصرتی، قلی قطب شاہ، ملا وجہی)

۱۶۔ پنجاب میں اُردو کا نظریہ کس نے پیش کیا؟ (مسعود حسن خاں، سید سلیمان ندوی، محمود شیرانی، عبدالسلام ندوی)

۱۷۔ غزل کی گردن بے تکلف مار دینی چاہیے۔ یہ قول کس کا ہے؟ (حالی، شبلی، عظمت اللہ خاں، کلیم الدین احمد)