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B.Pharm Syllabus

Semester V

Course Code	Name of the course	No. of hours per week (L/P)	Credit points
BP501T	Biomedical Chemistry (Theory)	3	3
BP502T	Industrial Pharmacognosy (Theory)	3	3
BP503T	Innovation and Startup Ecosystem (Theory)	2	2
BP504T	Pharmaceutical Dosage Form II (Theory)	2	2
BP505T	Pharmaceutical Quality Assurance (Theory)	3	3
BP506T	Systemic Pharmacology II (Theory)	3	3
BP507P	Biomedical Chemistry (Practical)	4	2
BP508P	Industrial Pharmacognosy (Practical)	3	1
BP509P	Pharmaceutical Dosage Form II (Practical)	3	1
BP510P	Systemic Pharmacology II(Practical)	4	2
Total		30	22

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Course Code	Course Title			Course Type
BP501T	Biomedical Chemistry (Theory)			Core
Credit	Hours Per Week (L-T-P)			Max. Hours.
	L	T	P	
3	3	--	--	45
Maximum Marks	SE			ESE
75	30			45

COURSE OBJECTIVES:

The objectives of this course are to:

1. Provide comprehensive knowledge of drugs acting on the central nervous system, including anesthetics, sedatives, antipsychotics, and anticonvulsants, with emphasis on their chemical classification and structure–activity relationships (SAR).
2. Familiarize students with anti-infective chemotherapeutic agents used against tuberculosis, malaria, protozoal, viral, fungal, helminthic, and urinary tract infections, including their chemical structures and SAR.
3. Impart understanding of antibiotics and sulfa drugs, focusing on their chemical classes, mechanisms, therapeutic relevance, and structure–activity relationships.
4. Introduce antineoplastic agents and endocrine drugs, highlighting their chemical nature, classification, therapeutic applications, and structure–activity correlations.
5. Develop knowledge of antidiabetic agents and narcotic analgesics, including opioid antagonists, with emphasis on medicinal chemistry principles and SAR of key drug classes.

COURSE OUTCOMES (CO):

CO No.	Upon successful completion of this course, the students will be able to:
1	Classify and explain the chemistry, therapeutic use, and structure–activity relationships of drugs acting on the central nervous system, including anesthetics, sedatives, antipsychotics, and anticonvulsants.
2	Describe the chemical classification, mechanism of action, and SAR of major anti-infective agents such as antituberculars, antimalarials, antivirals, antifungals, anthelmintics, and urinary tract anti-infectives.
3	Analyze the chemistry and SAR of antibiotics and sulfonamides and correlate structural features with antimicrobial activity and spectrum of action.
4	Explain the chemical basis, therapeutic significance, and SAR of antineoplastic agents and endocrine drugs used in cancer and hormonal disorders.
5	Interpret the chemistry, pharmacological relevance, and SAR of antidiabetic agents and narcotic analgesics, including opioid agonists and antagonists, for rational drug use and development.

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Detailed Syllabus:

Unit No.	Topics	No. of Lectures
	<i>Study of the development of the following classes of drugs includes chemical classification, structure, uses, SAR of selective drug classes, and synthesis of selected drugs as superscripted*</i>	
I	Drugs Acting on the Central Nervous System General Anesthetics Halothane, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane, Methohexital, Thiamylal, Thiopental, Ketamine*, Ramelteon, Remimazolam, Fospropofol, Dexmedetomidine Sedatives and Hypnotics Barbital, Phenobarbital*, Mephobarbital, Amobarbital, Butobarbital, Pentobarbital, Secobarbital, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem, Glutethimide, Meprobamate, Ethchlorvynol, Triclofos, Paraldehyde SAR of Barbiturates and Benzodiazepines Antipsychotics Promazine, Chlorpromazine*, Triflupromazine, Thioridazine, Piperacetazine, Prochlorperazine, Trifluoperazine, Chlorprothixene, Thiothixene, Loxapine, Clozapine, Haloperidol, Droperidol, Risperidone, Molindone, Sulpiride, Brexpiprazole, Lumateperone, Pimavanserin, Samidorphan SAR of Phenothiazines Anticonvulsants Phenobarbitone, Methabarbital, Phenytoin*, Mephénytoin, Ethotoin, Oxazolindiones: Trimethadione, Paramethadione Succinimides: Phensuximide, Methsuximide, Ethosuximide Phenacemide, Carbamazepine*, Clonazepam, Primidone, Valproic acid, Gabapentin, Felbamate, Perampanel, Lacosamide, Retigabine SAR of Anticonvulsants	10 Hours
II	Anti-Infective Chemotherapeutic Agents Antitubercular Agents Isoniazid*, Ethionamide, Ethambutol, Pyrazinamide, Para-amino salicylic acid*, Rifampicin, Rifabutin, Cycloserine, Streptomycin, Capreomycin, Pretomanid, Clofazimine, Levofloxacin, Bedaquiline, Linezolid, Delamanid Antimalarials Quinine, Chloroquine*, Amodiaquine, Primaquine, Pamaquine, Quinacrine, Mefloquine, Cycloguanil pamoate, Proguanil, Pyrimethamine, Artesunate, Artemether, Atovaquone	12 Hours

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	SAR of Quinoline derivatives Antiprotozoals Metronidazole*, Tinidazole, Ornidazole, Diloxanide, Iodoquinol, Pentamidine isethionate, Atovaquone, Eflornithine, Paromomycin, Nitazoxanide Antivirals Amantadine, Rimantadine, Idoxuridine, Acyclovir*, Ganciclovir, Zidovudine, Didanosine, Zalcitabine, Lamivudine, Loviride, Delavirdine, Ribavirin, Saquinavir, Indinavir, Ritonavir, Valganciclovir, Peramivir, Lenacapavir Antifungals Amphotericin-B, Nystatin, Natamycin, Griseofulvin, Clotrimazole, Econazole, Butoconazole, Oxiconazole, Tioconazole, Miconazole, Ketoconazole*, Terconazole, Itraconazole, Fluconazole, Naftifine, Tolnaftate, Posaconazole, Isavuconazole Anthelmintics Diethylcarbamazine, Thiabendazole, Mebendazole, Albendazole*, Niclosamide, Oxamniquine, Praziquantel, Ivermectin Urinary Tract Anti-infective Agents Nalidixic acid, Norfloxacin, Enoxacin, Ciprofloxacin*, Ofloxacin, Lomefloxacin, Sparfloxacin, Gatifloxacin, Furazolidone, Nitrofurantoin, Methenamine, Moxifloxacin SAR of Quinolones	
III	Antibiotics and Sulfa Drugs Antibiotics Penicillins, Cephalosporins, β-Lactamase inhibitors, Monobactams Aminoglycosides: Streptomycin, Neomycin, Kanamycin, Tetracyclines: Tetracycline, Oxytetracycline, Minocycline, Doxycycline, Macrolides: Erythromycin, Clarithromycin, Azithromycin Chloramphenicol*, Clindamycin, Clavulanic acid SAR of Penicillins, Tetracyclines, and Cephalosporins Sulfa Drugs Sulphamethizole, Sulfisoxazole, Sulphapyridine, Sulphathiazole, Sulfacetamide, Sulphamethoxazole, Sulphadiazine, Mefenide, Sulfasalazine, Trimethoprim, Cotrimoxazole, Dapsone* SAR of Sulfonamides	8 Hours
IV	Antineoplastic Agents Methotrexate, Cyclophosphamide, Melphalan, Chlorambucil, Busulfan, Thiopeta, Mercaptopurine*, Thioguanine, Fluorouracil, Floxuridine, Cytarabine, Methotrexate*, Azathioprine, Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin, Etoposide, Vinblastine, Vincristine, Paclitaxel, Camptothecin, Cisplatin, Mitotane, Carboplatin	6 Hours
V	Endocrine Drugs, Antidiabetic Agents and Narcotic Analgesics Endocrine Drugs	9 Hours

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Sex hormones: Testosterone, Nandrolone, Progesterone, Oestriol, Oestradiol, Oestrone, Diethylstilbestrol Drugs for erectile dysfunction: Sildenafil, Tadalafil Oral contraceptives: Mifepristone, Norgestrel, Levonorgestrel Corticosteroids: Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone Thyroid and antithyroid drugs: L-Thyroxine, L-Thyronine, Propylthiouracil, Methimazole Antidiabetic Agents Insulin and preparations, Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride Biguanides: Metformin Thiazolidinediones: Pioglitazone, Rosiglitazone Repaglinide, Nateglinide, Acarbose, Voglibose Narcotic Analgesics Morphine, Codeine, Meperidine, Anilerdine, Diphenoxylate, Loperamide, Fentanyl*, Methadone, Propoxyphene, Pentazocine, Levorphanol Nalorphine, Levallorphan, Naloxone SAR of Morphine analogues	
Recommended References (Preferably latest editions): 1. Abraham, D. J. and Griffin, J. L. <i>Burger's Medicinal Chemistry and Drug Discovery</i>. Wiley. 2. Brunton, L., Hilal-Dandan, R. and Knollmann, B. <i>Goodman and Gilman's The Pharmacological Basis of Therapeutics</i>. McGraw-Hill Education. 3. Kar, Ashuthosh. <i>Medicinal Chemistry</i>. New Age International. 4. Lednicer, D. <i>The Organic Chemistry of Drug Synthesis</i>. Wiley. 5. Li, J. J. <i>Modern Drug Synthesis</i>. Wiley. 6. Patrick, G. L. <i>An Introduction to Medicinal Chemistry</i>. Oxford University Press. 7. Vogel, A. I. <i>Vogel's Textbook of Practical Organic Chemistry</i>. Pearson Education. 8. Williams, D. A., Lemke, T. L. and Roche, V. F. <i>Foye's Principles of Medicinal Chemistry</i>. Lippincott Williams & Wilkins. 9. Wilson, C. O., Beale, J. M. and Block, J. H. <i>Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry</i>. Lippincott Williams & Wilkins.	

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Course Code	Course Title			Course Type
BP502T	Industrial Pharmacognosy (Theory)			Core
Credit	Hours Per Week (L-T-P)			Max. Hours.
	L	T	P	
3	3	--	--	45
Maximum Marks	SE			ESE
75	30			45

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce students to the industrial, commercial, and economic aspects of herbal drugs in national and global markets.
2. Knowledge of commercial production, quality assurance, and standardization of herbal extracts, volatile oils, and traditional AYUSH formulations
3. Train students in modern analytical techniques for the identification, characterization, and quality evaluation of plant-based drugs and herbal products
4. Develop skills in isolation, characterization, commercial production, and analysis of bioactive phytoconstituents.
5. Familiarize students with national and international regulatory frameworks, pharmacopoeial standards, and safety, efficacy, and pharmacovigilance requirements governing herbal medicinal products.

COURSE OUTCOMES (CO):

CO No.	Upon successful completion of this course, the students will be able to
1	Describe the economic significance, trade potential, emerging therapeutic categories, and institutional support for medicinal and aromatic plant-based industries at national and international levels.
2	Explain the principles of commercial production, standardization, and quality control of herbal extracts, volatile oils, cosmeceuticals, and traditional formulations in compliance with AYUSH, WHO-GMP, and global regulatory norms.
3	Demonstrate analytical competence in evaluating herbal drugs and botanicals using modern spectroscopic and chromatographic techniques such as UV, IR, NMR, MS, HPTLC, HPLC, UPLC, and GC.
4	Describe the process to isolate, characterize, identify, and analyze important phytoconstituents used in pharmaceutical, nutraceutical industries.
5	Interpret and apply international regulatory guidelines, pharmacopoeial monographs, and safety, efficacy, and pharmacovigilance requirements for herbal and traditional medicinal products

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Detailed Syllabus:

Unit No.	Topics	No. of Lectures
I	General Introduction to Herbal Industries, institutions and trade status of herbals (a) Role of medicinal and aromatic plants trade in national economy of a country and introduction of Current trade status and potential of some commercially important medicinal plants/natural products like Ashwagandha, Turmeric, Ginseng, Amla and essential oils. (b) A brief account of bioeconomy, biodiversity hot spots and plant-based industries and institutions involved in research work on medicinal and aromatic plants in India. (c) Emerging therapeutic categories of Herbal Medicinal Products available in market, their composition with rationale for Aphrodisiac, Antistress, anti-diabetics, antihyperlipidemic, immunomodulator, hepatoprotective and kidney disorders (d) Emerging Herbal cosmeceuticals: Anti-Aging, Depigmenting, anti-acne, sunscreen, detoxifying, anti-irritant, nutricosmetics.	8 Hours
II	Commercial Production and Standardization of botanicals Significance of AYUSH/ WHO-GMP, GLP and USFDA compliant facility in production of quality herbal products. Commercial production of standardized herbal extracts with clinical relevance: Coleus, Amla, Turmeric, Ashwagandha and Senna. Commercial production and standardization of volatile oils: Eucalyptus oils, Lavender oil and Peppermint oil, Rosemary oil Preparation and standardization of Ayush formulations viz Aristas and Asawas, Ghutika/Habb, Churna/ Shafoof Arq, Sharbat, Tincture and Bhasma.	10 Hours
III	Modern methods of analysis of Plants and Plant-based products Basic principles and applications in analysis of botanicals: Spectroscopic methods: UV-Visible spectroscopy, IR Spectroscopy, NMR spectroscopy and Mass spectroscopy, Atomic Absorption Spectroscopy Chromatographic methods: HPTLC, HPLC, UPLC, GC,	12 Hours
IV	Isolation, Characterization, Commercial Production and analysis of bioactive phytoconstituents Isolation, characterization with commercial production, identification and analysis of bioactive phytoconstituents: Artemisinin, Sennosides, Withanolids, Boswellic acid, Atropine, and Lycopene.	08 Hours
V	International Regulatory Perspectives (a) Overview of global regulations for herbal products (e.g., World	07 Hours

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	Health Organization, United States Food and Drug Administration – Dietary Supplement Health and Education Act, European Medicines Agency, TGA-ARG Therapeutic Goods Administration – Australian Regulatory Guidelines for Complementary Medicines, Natural Health Products (Canada) (b) Harmonization challenges and mutual recognition of traditional medicine (c) Importance of safety, efficacy and pharmacovigilance in herbal product regulation (d) Study of Monographs on herbal drugs and botanicals related to Indian Pharmacopoeia, United States Pharmacopoeia Herbal Medicine and Dietary Supplement, Ayurvedic Pharmacopoeia of India and Unani Pharmacopoeia of India.	
Recommended References (Preferably latest editions) 1. Ayurvedic Pharmacopoeia Committee. <i>Ayurvedic Pharmacopoeia of India</i>. Government of India, Ministry of AYUSH. 2. European Medicines Agency. <i>Herbal Monographs and Regulatory Guidelines</i>. 3. Indian Drug Manufacturers' Association. <i>Indian Herbal Pharmacopoeia</i>. 4. Indian Pharmacopoeia Commission. <i>Indian Pharmacopoeia</i>. Government of India. 5. International Council for Harmonisation. <i>ICH Guidelines on Quality, Safety, Efficacy and Multidisciplinary Topics</i>. 6. Natural Health Products Directorate. <i>Regulatory Framework for Natural Health Products</i>. 7. Unani Pharmacopoeia Committee. <i>Unani Pharmacopoeia of India</i>. Government of India, Ministry of AYUSH. 8. United States Pharmacopoeial Convention. <i>United States Pharmacopoeia</i>. 9. World Health Organization. <i>Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants</i>. 10. <i>Drugs and Cosmetics Act and Rules (India)</i>. Government of India.		

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Course Code	Course Title			Course Type
BP503T	Innovation and Startup Ecosystem (Theory)			Core
Credit	Hours Per Week (L-T-P)			Max. Hours.
	L	T	P	
2	2	--	--	30
Maximum Marks	SE	ESE		
50	20	30		

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce students to the fundamental concepts, principles, and significance of innovation and entrepreneurship in contemporary economic and social contexts.
2. Familiarize students with the structure, components, and key stakeholders of the startup and innovation ecosystem.
3. Provide students with an understanding of the startup lifecycle, including ideation, opportunity analysis, product development, validation, and scaling.
4. Equip students with practical tools and techniques for problem identification, opportunity recognition, business model development, and idea validation.
5. Foster an entrepreneurial mindset by encouraging active participation in innovation-related events, stakeholder interactions, and experiential learning activities.

COURSE OUTCOMES (CO):

CO No.	Upon successful completion of this course, the students will be able to:
1	Explain the fundamental concepts of innovation, entrepreneurship, and the structure and role of the startup ecosystem in economic and social development.
2	Identify and analyze problems, market gaps, and opportunities using ideation tools, market research techniques, and feasibility analysis.
3	Design and validate an innovative solution by developing a minimum viable product (MVP) using lean startup principles and customer feedback.
4	Develop an appropriate business model using the Business Model Canvas, and evaluate legal, intellectual property, team, and funding considerations for startups.
5	Demonstrate effective ecosystem engagement skills by participating in innovation events and presenting a concise startup pitch, incorporating future trends and scaling strategies.

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Detailed Syllabus:

Unit No.	Topics	No. of Lectures
I	Unit I: Introduction to Innovation and Entrepreneurship Defining Innovation and Entrepreneurship • What is Innovation? • Types of Innovation: Product, Process, Business Model, Social • What is Entrepreneurship? • Characteristics of an Entrepreneur Invention vs Innovation • Distinction between Invention and Innovation • Importance of Innovation in the 21st Century ◦ Economic growth and job creation ◦ Solving societal problems • Disruptive technologies and their impact Case Studies • Innovative companies (e.g., Apple, Google, Tesla) Introduction to the Startup Ecosystem • Key components: ◦ Entrepreneurs ◦ Incubators/Accelerators ◦ Mentors ◦ Investors ◦ Government ◦ Academia ◦ Support Services • Role of each component in fostering innovation Practical Aspect: Participation in National Innovation Day and National Startup Day	06 Hours
II	Unit II: Ideation and Opportunity Identification Identifying Problems and Market Gaps • Problem-solving approach to entrepreneurship • Techniques for problem identification: ◦ Observation ◦ Empathy mapping ◦ User interviews	06 Hours

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	- Market research basics: - Understanding customer needs and pain points Generating Innovative Ideas - Brainstorming techniques: - SCAMPER - Mind Mapping - Design Thinking principles for ideation - Lateral thinking and divergent thinking - From problem to solution: developing initial concepts Opportunity Analysis and Feasibility - Market sizing and potential - Competitive analysis - SWOT analysis for new ventures Practical Aspect: Participation in Ideation Challenges or Hackathons (e.g., <i>Smart India Hackathon</i> or IIC internal ideation competitions)	
III	Unit III: Building a Minimum Viable Product (MVP) and Validation Lean Startup Methodology - Introduction to Lean Startup principles - Build–Measure–Learn feedback loop - Concept of MVP: - Importance - Scope and objectives Designing and Developing an MVP - Different types of MVPs - Tools and resources for rapid prototyping - User experience basics for MVPs Validation - Customer interviews and feedback collection - A/B testing and split testing - Pivoting vs Persevering Practical Aspect: Participation in sessions/workshops on Prototype, MVP, and Product Development	06 Hours
IV	Unit IV: Business Models and Startup Operations Business Model Canvas (BMC) - Introduction to the 9 building blocks of BMC - Developing a BMC for a new venture - Value Proposition Design Legal and Financial Aspects for Startups - Legal structures: - Sole Proprietorship	06 Hours

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	○ Partnership ○ Private Limited Company • Intellectual Property Rights (IPR): ○ Patents ○ Trademarks ○ Copyrights • Startup funding: ○ Bootstrapping ○ Angel investors ○ Venture capital Team Building and Mentorship • Importance of a strong founding team • Roles and responsibilities in a startup • Value of mentors and advisors Practical Aspect: Participation in IPR awareness programs or startup funding sessions	
V	Unit V: Scaling, Ecosystem Engagement, and Future Trends Growth Strategies and Scaling Up • Marketing and sales for startups • User acquisition and retention • Challenges of scaling and solutions • Exit strategies: ○ Acquisition ○ IPO Engaging with the Startup Ecosystem • Networking with investors, mentors, and entrepreneurs • Participation in startup competitions and pitch events • Leveraging incubators and accelerators Future Trends in Innovation and Entrepreneurship • Emerging technologies: ○ Artificial Intelligence ○ Blockchain ○ Internet of Things (IoT) ○ Sustainable Technologies • Social entrepreneurship and impact investing • Global startup trends Practical Aspect: Participation in National Innovation Day and student engagement activities to prepare and deliver a concise pitch for their developed idea, simulating a startup pitch event.	06 Hours
Recommended References (Preferably latest editions)		

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1. Eric Ries. *The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses*. Crown Business.
2. Thiel, P. and Masters, B. *Zero to One: Notes on Startups, or How to Build the Future*. Crown Business.
3. Bansal, R. *Stay Hungry Stay Foolish*. Westland.
4. Dalal, M. *Big Billion Startup: The Untold Flipkart Story*. Pan Macmillan India.
5. Ivaturi, V. K. *The Manual for Indian Start-Ups: Tools to Start and Scale-Up Your New Venture*. Notion Press.
6. Mishra, S., Patjoshi, P. K. and Patnaik, S. K. *Innovation and Entrepreneurship*. Pearson India.
7. Sardar, R. and Waghmare, G. *Startup Ecosystem in India: Text and Cases*. Himalaya Publishing House.



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Course Code	Course Title			Course Type
BP504T	Pharmaceutical Dosage Forms II (Theory)			Core
Credit	Hours Per Week (L-T-P)			Max. Hours.
	L	T	P	
2	2	--	--	30
Maximum Marks	SE			ESE
50	20			30

COURSE OBJECTIVES:

The objectives of this course are to:

1. Understand the principles of formulation and development of monophasic liquid dosage forms, including solvent selection and solubility enhancement techniques.
2. Acquire knowledge of biphasic liquid dosage forms, including physicochemical principles, formulation strategies, manufacturing processes, and stability considerations.
3. Develop competence in pressurised dosage forms such as aerosols, metered-dose inhalers, and dry powder inhalers, with emphasis on formulation design, device components, manufacturing, and quality evaluation.
4. Understand the formulation, manufacturing, and evaluation of semisolid dosage forms, with emphasis on drug permeation through the skin and factors affecting topical drug delivery.
5. Gain exposure to advanced drug delivery systems such as nanosuspensions, nanoemulsions, SMEDDS/SNEDDS, xerogels, and emulgels for improved therapeutic performance.

COURSE OUTCOMES (CO):

CO No.	Upon successful completion of this course, the students will be able to:
1	Explain the fundamental principles, classification, formulation requirements, and quality aspects of monophasic and biphasic liquid dosage forms.
2	Formulate, manufacture, and evaluate monophasic and biphasic liquid preparations, including solutions, syrups, elixirs, suspensions, and emulsions, using appropriate excipients and processing techniques.
3	Apply physicochemical principles such as solubility enhancement, Stokes' law, DLVO theory, and emulsification theories to design stable liquid dosage forms and assess their stability and performance.
4	Design and evaluate pressurised and inhalation dosage forms, including aerosols, metered dose inhalers, and dry powder inhalers, by selecting suitable formulation components, devices, and quality control parameters.
5	Formulate, evaluate, and justify the use of semisolid and advanced drug delivery systems—including ointments, creams, gels, suppositories, nanosuspensions, nano-

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	emulsions, SMEDDS/SNEDDS, xerogels, and emulgels—for enhanced drug delivery, stability, and patient compliance.
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Detailed Syllabus:

Unit No.	Topics	No. of Lectures
I	Monophasic Liquids & Pressurised Dosage Forms Foundations: Need, advantages/limitations; monophasic vs biphasic; solubility-enhancement techniques. Vehicles & solvents: Pharmaceutical waters (types; manufacturing & Quality Control of Purified/Distilled); classes of solvents as per toxicity. Formulation & manufacturing: Raw-material considerations and additives; processing; Quality Control of solutions/syrups/elixirs; powders for reconstitution as solutions. Measuring, filling & packaging: Techniques; container-closure integrity; automation in liquid manufacturing.	06 Hours
II	Biphasic Liquids - Suspensions Formulation & manufacturing: Additives; classification of suspending agents; IPQC & Quality Control; instabilities and packaging. Advances: Nanosuspensions; dry powder for reconstitution as suspensions; raft- forming systems.	06 Hours
III	Biphasic Liquids - Emulsions Formulation & manufacturing: Additives; classification of emulsifying agents; IPQC & Quality Control; instabilities and packaging. Advances: Nano-emulsions, micro-emulsions, SMEDDS/SNEDDS (overview, applications).	06 Hours
IV	Pressurized dosage forms (Aerosols/MDIs) Concepts; propellant classification/selection; valves & containers; formulation, manufacturing, and Quality Control (leak, spray pattern, delivered dose, particle- size/aerodynamic performance). Dry Powder Inhalers: valves & containers; formulation, manufacturing, and Quality Control	06 Hours
V	Semisolid Dosage Form Theory of Semisolid Dosage Forms: Definition & Purpose, Drug Permeation Pathways through skin ,Factors affecting Permeation, Permeation enhancers: Physical and Chemical. Types of semisolid dosage form: • Ointments: Base Selection, Formulation , Manufacturing and Evaluation	06 Hours

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• Creams: Formulation, Manufacturing and Evaluation • Gels/Jellies: Formulation, Manufacturing and Evaluation. • Pastes: Formulation, Manufacturing and Evaluation • Suppositories and Pessaries: Formulation, Manufacturing and Evaluation Advances: Xerogels, emulgels (overview, applications).	
Recommended References (Preferably latest editions) 1. Aulton, M. E. <i>Aulton's Pharmaceutics: The Science of Dosage Form Design</i>. Elsevier. 2. Gibson, M. <i>Pharmaceutical Preformulation and Formulation</i>. CRC Press. 3. Lachman, L., Lieberman, H. A. and Kanig, J. L. <i>The Theory and Practice of Industrial Pharmacy</i>. CBS Publishers & Distributors. 4. Robinson, J. R. and Lee, V. H. L. <i>Controlled Drug Delivery: Fundamentals and Applications</i>. CRC Press. 5. Troy, D. B. and Beringer, P. <i>Remington: The Science and Practice of Pharmacy</i>. Pharmaceutical Press. 6. <i>Indian Pharmacopoeia</i>. Indian Pharmacopoeia Commission.	

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Course Code	Course Title			Course Type
BP505T	Pharmaceutical Quality Assurance (Theory)			Core
Credit	Hours Per Week (L-T-P)			Max. Hours.
	L	T	P	
3	3	--	--	45
Maximum Marks	SE			ESE
75	30			45

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce the concepts and systems of pharmaceutical quality management
2. Provide an overview of regulatory frameworks governing pharmaceutical quality.
3. Familiarize students with organizational, infrastructural, and operational requirements of pharmaceutical manufacturing and quality control.
4. Explain quality control testing of pharmaceutical products
5. Understand the documentation, validation, calibration, and data integrity essential for regulatory compliance.

COURSE OUTCOMES (CO):

CO No.	Upon successful completion of this course, the students will be able to:
1	Explain the concepts of QA, QC, GMP, GLP and modern Quality Management Systems.
2	Apply TQM, QbD, and ICH guidelines to ensure consistent pharmaceutical quality.
3	Understand requirements related to personnel, premises, equipment, materials, and documentation.
4	Describe quality control testing of pharmaceutical products.
5	Explain calibration, qualification, and analytical method validation as per regulatory guidelines.

Detailed Syllabus:

Unit No.	Topics	No. of Lectures
I	Quality Assurance and Quality Management Systems	10 hours
	1. Quality Assurance and Quality Management concepts: Definition and concepts of Quality Control, Quality Assurance, and GMP	
	2. Total Quality Management (TQM): Definition, elements, and philosophies	
	3. ICH Guidelines: Purpose, process of harmonization, overview of QSEM with special emphasis on Q-series guidelines	

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	4. Quality by Design (QbD): Definition, overview, elements of QbD program, and tools 5. ISO 9000 and ISO 14000: Overview, benefits, elements, and steps for registration 6. NABL Accreditation: Principles and procedures	
II	Organization, Personnel, Premises, and Materials Management 1. Organization and Personnel: Responsibilities, training, hygiene, and personal records 2. Premises: Design, construction, plant layout, maintenance, sanitation, environmental control, utilities, and control of contamination 3. Equipment and Raw Materials: Equipment selection, User Requirement Specifications (URS), handling and maintenance of raw materials 4. Warehousing: Good warehousing practices and materials management	10 hours
III	Quality Control and Good Laboratory Practices 1. Quality Control Tests for Formulations: In-process and finished product quality control tests for tablets, capsules, ointments, creams, ophthalmic and parenteral preparations 2. Quality Control of Raw Materials and Packaging Materials: Tests for raw materials, containers, rubber closures, and secondary packing materials 3. Good Laboratory Practices (GLP): General provisions, organization and personnel, facilities and equipment, ALCOA principles, reference standards, testing facility operations, records and reports, and disqualification of testing facilities	10 hours
IV	Documentation, Complaints, and Product Recall 1. Documentation in the Pharmaceutical Industry: Batch Formula Record, Master Formula Record, Drug Master File, SOPs, quality audits, preparation, handling, archival, and distribution of records 2. Complaints and Product Recall: Handling of complaints, evaluation of complaints, returned goods, recalls, and waste disposal	08 hours
V	Calibration and Validation 1. Calibration and Validation: Introduction, definitions, importance, and general principles Calibration of weights and measures, pH meter Qualification of UV-Visible spectrophotometer, electronic balance, IR spectrophotometer, and HPLC 2. Analytical Method Validation: General principles of analytical method validation as per ICH Q2 guidelines	07 hours
Recommended References (Preferably latest editions) 1. Godfrey, A. B. and Juran, J. M. Juran's Quality Handbook. McGraw-Hill Education. 2. Organisation of Pharmaceutical Producers of India. Quality Assurance Guide. OPPI.		

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3. Weinberg, S. Good Laboratory Practice Regulations. Marcel Dekker.
4. World Health Organization. Quality Assurance of Pharmaceuticals: A Compendium of Guidelines and Related Materials. World Health Organization.

Course Code	Course Title		Course Type	
BP506T	Systemic Pharmacology II (Theory)		Core	
Credit	Hours Per Week (L-T-P)			Max. Hours.
	L	T	P	
3	3	--	--	45
Maximum Marks	SE		ESE	
75	30		45	

COURSE OBJECTIVES:

The objectives of this course are to:

1. Understand the neurohumoral transmission in the central nervous system and the role of neurotransmitters and their modulators in CNS disorders.
2. Learn the pharmacology of drugs used in pathological conditions of CNS, GIT, and endocrine system.
3. Familiarize learners with concepts of drug abuse, addiction, dependence, tolerance, and their management.
4. Impart comprehensive knowledge of chemotherapeutic agents including anticancer drugs.
5. Introduce the principles of rational use of chemotherapeutic agents.

COURSE OUTCOMES (CO):

CO No.	Upon successful completion of this course, the students will be able to
1	Identify the role of neurotransmitters in CNS diseases and explain pharmacology of drugs acting on central neurotransmission.
2	Apply principles of chemotherapy to explain mechanisms and uses of chemotherapeutic agents.
3	Recall pharmacology of hormones and drugs used in endocrine disorders.
4	Describe mechanisms and therapeutic uses of drugs acting on the gastrointestinal tract.
5	Recognize issues related to drug abuse, addiction, and dependence and their management.

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Detailed Syllabus:

Unit No.	Topics	No. of Lectures
I	Pharmacology of Drugs Acting on Central Nervous System Neurohumoral transmission in the CNS; physiological roles of GABA, glutamate, glycine, serotonin, and dopamine. a. General anesthetics, pre-anaesthetic medications, and local anaesthetic agents b. Sedative–hypnotics c. Alcohol and disulfiram d. Opioids, opiate analgesics, and antagonists e. Drugs used in epilepsy f. Drugs used in Parkinson's and Alzheimer's diseases	10 hours
II	Pharmacology of Drugs Used in Psychiatry a. Antipsychotics, antidepressants, anti-anxiety drugs, mood stabilizers, CNS stimulants, and hallucinogens b. Substance abuse, drug addiction, and general principles of de-addiction	07 hours
III	Chemotherapy i) Introduction a. Definitions of chemotherapy, chemotherapeutic index, antibiotics, and antimicrobial agents b. Concept of selective targeting in chemotherapy c. Classification of antimicrobial agents based on mechanism of action d. Concept of superinfection, chemoprophylaxis, and combined use of antibiotics e. Antimicrobial resistance: causes, mechanisms, and preventive measures ii) Antimicrobial Agents Classification, mechanism of action, adverse drug reactions, and therapeutic uses of: • Sulphonamides and cotrimoxazole • Fluoroquinolones • Penicillins and cephalosporins • Macrolides and tetracyclines • Linezolid • Carbapenems and monobactams • Chloramphenicol and aminoglycosides iii) Chemotherapy of Diseases Drugs used in the treatment of: • Fungal infections • Viral infections	14 hours

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	• Helminthiasis • Urinary tract infections • Tuberculosis • Leprosy • Malaria • Amoebiasis • Neoplastic diseases	
IV	Pharmacology of Drugs Acting on Endocrine System - Introduction to basic concepts of endocrinology - Thyroid and antithyroid agents - Parathormone, calcitonin, and vitamin D - Insulin and oral hypoglycaemic agents - ACTH and corticosteroids - Oral contraceptives - Drugs acting on the uterus - PCOD	10 hours
V	Drugs Acting on Gastrointestinal Tract - Drugs used in peptic ulcer - Drugs used for constipation and diarrhoea - Emetics and anti-emetics - Digestants, carminatives, appetizers, and anorectics – definitions and examples	04 hours
Recommended References (Preferably latest editions): 1. Brunton, L., Hilal-Dandan, R. and Knollmann, B. <i>Goodman and Gilman's The Pharmacological Basis of Therapeutics</i>. McGraw-Hill Education. 2. Craig, C. R. and Stitzel, R. E. <i>Modern Pharmacology with Clinical Applications</i>. Lippincott Williams & Wilkins. 3. DiPiro, J. T., Talbert, R. L., Yee, G. C. and Matzke, G. R. <i>Pharmacotherapy: A Pathophysiologic Approach</i>. McGraw-Hill Education. 4. Katzung, B. G. and Trevor, A. J. <i>Basic and Clinical Pharmacology</i>. McGraw-Hill Education. 5. Rang, H. P., Dale, M. M., Ritter, J. M., Flower, R. J. and Henderson, G. <i>Rang and Dale's Pharmacology</i>. Elsevier. 6. Tripathi, K. D. <i>Essentials of Medical Pharmacology</i>. Jaypee Brothers Medical Publishers.		