Subject :Pharmacology **Subject Code:** **20221**

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.
8) As per the policy decision of Maharashtra State Government, teaching in English/Marathi and Bilingual (English + Marathi) medium is introduced at first year of AICTE diploma Programme from academic year 2021-2022. Hence if the students write answers in Marathi or bilingual language (English +Marathi), the Examiner shall consider the same and assess the answer based on matching of concepts with model answer.

Q. No.	Sub Q. No.	Answer	Marking Scheme
1		**Answer any SIX of the following:**	**30 M**
1.	a	**Define Antihypertensive agents. Classify them. Mention types of hypertension.** These are the pharmacological agents used in treatment of hypertension. **Eg.**Clonidine,Atenolol,Losartan,Methyldopa,Hydralazine,Reserpine,Propranolol,Diazoxide, Thiazides etc **Classification (According to site of action):** 1. Centrally acting Drugs: Clonidine, Methyl Dopa 2. Drugs acting on autonomic ganglia: Hexamethonium 3. Drugs acting on sympathetic(adrenergic) nerve endings a) Adrenergic neuron blockers; Guanethidine	**1M Def** **3M Classify** **1M Types**

		b) Catecholamine depletors: Reserpine 4. Drugs acting on adrenergic receptors: a)Alpha adrenergic blockers: Phentolamine b) Beta adrenergic blockers: Propranolol 5. Vasodilators: Hydralazine 6. Drugs acting reflexly by stimulating baroreceptors: Veratrum 7. Oral Diuretics: Thiazides, Frusemide, spironolactone, amiloride etc 8. Calcium Channel Blockers: Nifedipine, Amlodipine, Felodipine 9. Drugs acting on renin angiotensin system: a) ACE inhibitors: Enalapril, ramipril b) Angiotensin Receptor Blockers: Losartan, Telmisartan 10.Miscellaneous: MAO inhibitors eg. Pargyline **Types of hypertension:** **a) Primary hypertension:** Where the cause which leads to rise in blood pressure is not known and is usually a lifelong condition **b) Secondary hypertension:** is developed secondary to some other primary cause and is usually for a temporary period. eg. renal diseases, endocrine diseases like cushings syndrome, excess of catecholamine (Pheochromocytoma), pregnancy, side effect of drugs like sympathomimetic amines, oestrogens (combined oral contraceptive pills), erythropoietin, NSAIDs, Steroids etc.	
1.	**b**	**What are opioid analgesics? Give examples. Write pharmacological actions of morphine.** **Definition:** These are the pharmacological agents, which when administered, relieve severe degrees of pain associated with burns, parturitions, fractures, traumas, tumors, malignancy etc. by affecting degree of consciousness. Examples: Morphine, Codeine, Thebaine, Papavarine, Noscapine, pholcodeine etc.(any 2 correct examples is fine) **Pharmacological actions of morphine:** **1. Action on central nervous system;**	**1M Def.** **1M Ex.** **3M Pharm. Action**

		a) Analgesia: morphine when administered relieves severe degree of pain associated with trauma, fractures malignancy, it increases pain threshold, it decreases perception of pain sensation. b) Euphoria: It produces euphoria even in absence of pain, which may lead to addiction. c) Sedation: Therapeutic dose of morphine induces drowsiness decreased physical activity, difficulty in concentration and lack of thoughts. d) Hypnosis: morphine when consumed produces sleep which is not related to natural sleep and characterized by colourful vivid dreams. **2. Action on respiratory system:** Morphine produces respiratory depression by direct depressant action on the brain stem and respiratory centre. In toxic doses morphine produces severe depression of the respiratory centre. **3. Action on pupil:** Morphine acts on the oculomotor nerve and produces pinpoint pupil**.** **4. Action on cough centre:** Morphine depresses cough reflex by directly depressing medullary cough centre. **5. Action on CTZ: (chemoreceptor trigger zone)** Morphine acts on CTZ in the medulla by stimulation and produces nausea and vomiting. **6. Action on GIT:** Morphine reduces tone, motility, peristalsis of smooth muscles of gastrointestinal tract, reduces all digestive enzymes and leads to constipation	
1.	**c**	**Define Bioavailability and Biotransformation. Explain various routes of drug excretion.** **Bioavailability:** It is the amount of drug which actually reaches systemic circulation or site of action from a given dosage form after its administration. This amount of the drug is responsible for its therapeutic effect. Depending on the dosage forms, bioavailability differs. E.g after Intravenous route, bioavailability is 100%. **Biotransformation-** It is the alteration of drugs within living organisms so as to modify its activity or nature.It is the process of metabolism of the drugs which prepare the drugs for excretion. **Various routes of drug excretion:** • Kidneys: Most of the drugs are excreted in urine. Weak acids are quickly excreted in alkaline urine & vice versa. Eg Penicillin, salicylic acid	**1M Each defi.** **3M Routes of Drug excretion**

		• Lungs: eg. Excretion of gaseous inhalants.Volatile general anesthetics, alcohol, paraldehyde occur through this route and it can be easily detected by breath smell • Intestines: Purgatives like senna are partly excreted in intestine . Heavy metals are also excreted through faeces. • Skin: eg.Metalloids like arsenic, lead • Saliva & milk: eg.Antibiotics, sulphonamides, morphine are excreted in milk. • Bile: eg.Erythromycin, novobiocin eliminated in bile , reabsorbed in intestine. It prolongs the action.	
1.	**d**	**Define Chemotherapy. Give classification of antibiotics based on type of bacteria. Explain drug combination is used in treatment of tuberculosis.** **Chemotherapy:** It is defined as the use of chemical compounds in the treatment of cancer and infectious diseases, so as to destroy the microorganisms without damaging the host tissues. Ex. Peniciliins, Cephalosporins, Tetracyclines, Streptomycin, Amoxycillin, etc. **Classification:** 1) Effective against gram-positive bacteria a) Used for systemic infections eg. Penicillin, Erythromycin b) Used topically e.g. Bacitracin. 2) Effective against Gram Negative bacteria a) Used for systemic infections eg Streptomycin, Kanamycin b) Used locally in intestinal infections eg. Paromomycin 3) Effective against both gram positive and Gram Negative bacteria a) Used for systemic infections eg. Ampicillin, Amoxicillin ,Carbenicillin b) Used topically eg. Neomycin, Framycetin 4) Effective against gram-positive and gram-negative bacteria ,rickettsiae and Chlamydia eg Tetracycline, Chloramphenicol	**1M Def.** **2M Classification** **2M Treatment**

		5) Effective against acid fast bacilli eg. Rifampicin, Streptomycin **Explain drug combination is used in treatment of tuberculosis**. i) Resistance to anti-TB drugs is developed quickly if used as a single drug. ii) Combination therapy reduces bacterial load effectively and quickly. iii) Combination therapy gives synergistic effects. iv) Side effects are lesser with combination than with single drug used in high dose.	
1.	**e**	**Define Local Anaesthetics. Give two examples. Write uses of local anaesthetic.** Definition: Local anaesthetics are pharmacological agents which when applied or injected, block the conduction as well as generation of impulses in localized area and bring reversible loss of sensation without affecting the degree of consciousness. Examples : Cocaine, Procaine, Amethocaine, Cinchocaine ,Lignocaine (Lidocaine) Therapeutic uses of Local anaesthetics: • To reduce pain and itching of ulcers, haemorrhoids • To anaesthetize corneal surface, mucosa of mouth, nose, pharynx, larynx, urethra etc. • It is used for minor surgeries like removal of cyst. • It used in gynaecological surgery • It is used in dental procedures • Local anesthesia is also used during insertion of IV devices, such as pacemakers and implantable defibrillators, ports used for giving chemotherapy medications and hemodialysis access catheters	**1M def. 1M examples 3M uses**
1.	**f**	**i) What are corticosteroids? give examples** Corticosteroids are adrenocortical hormones produced and released by the adrenal cortex. The secretion of adrenocortical steroids is controlled by the pituitary release of corticotropin i.e. ACTH- adrenocorticotropic hormone. **Corticosteroids** are a class of steroid hormones .Synthetic analogues of these hormones are also available .	**2.5M Each**

• Two main classes of corticosteroids, glucocoticoids and mineralocorticoids, are involved in a wide range of physiological processes, including stress response , immune response, and regulation of inflammation, carbohydrates metabolism, protein metabolism, blood electrolyte levels, and behaviour.

These are mainly used as ant-inflammatory agents in chronic asthma, various auto-immune disorders, various skin disorders, and several emergency situations.

Ex. Cortisol, Hydrocortisone, prednisolone, dexamethasone etc

Side effects include: Hypertension, weight gain, osteoporosis, hyperacidity, hair loss etc

ii) Write a note on Thyroid hormones.

The thyroid gland is situated at the base of the throat having two symmetrical lateral lobe, one on either side of the trachea, joined by a thin portion of thyroid tissue known as isthmus. The thyroid glands synthesize two important hormones thyroxin (T4) and triiodothyronine (T3). About 90% of the body iodine is present in the thyroid gland mainly as organic iodine.

Thyroid hormones are essential for

- Mental and physical growth
- Carbohydrate, fat and protein metabolism
- Temperature regulation
- Myelination of nerve fibres
- Myocardial contractions
- As a serum cholesterol lowering agent

Inadequate or excessive secretion of these hormones results in the clinical condition known as hypothyroidism and hyperthyroidism.

Thyroxine and levothyroxine are used to treat hypothyroidism, cretinism, goitre and myxodema

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1.	**g**	**Define Antiemetics. Give two examples, Classify antiulcer agents with examples.** **Antiemetics:** These are the pharmacological agents used in the treatment of vomiting. Eg: Phenothiazine derivative(Chlorpromazine), Hyoscine, Meclizine, Promethazine, Domperidone, Ondansetron **Classification:** 1. Reduction of gastric acid secretion a) H2 antihistamines: Ex. Cimetidine, Ranitidine, Famotidine, Roxatidine b) Proton pump inhibitors: Ex. Omeprazole, lansoprazole, Pantoprazole, Rabeprazole, Dexrabeprazole c) Anticholinergic drugs: Pirenzepine, Propantheline, Oxyphenonium. d) Prostaglandin analogue: Misoprostol 2. Neutralization of gastric acid (Antacid) a) Systemic antacid: Ex. Sodium bicarbonate, Sodium citrate b) Non-Systemic antacid: Ex. Magnesium hydroxide, Magnesium trisilicate, Aluminium hydroxide gel, Calcium carbonate, magaldrate 3. Ulcer protectives:Ex. Sucralfate, bismuth subcitrate,carbenoxolone 4. Anti-H Pylori Drugs: Ex. Amoxicillin Clarithromycin, Metronidazole, Tinidazole	**1M def.** **1M Ex.** **3M Classification**

Q. No.	Sub Q. N.	Answer	Marking Scheme
2		**Answer any <u>TEN</u> of the following:**	**30M**

2	a	**Describe the drugs used in the treatment of atherosclerosis.** The drugs used in the treatment of atherosclerosis are called as Hypolipidemic / Anti-hyperlipidaemic drugs.These are the pharmacological agents that are used to lower increased blood lipid levels.. Drugs used to reduce blood clots (thrombus) may also be required in the treatment as well as antihypertensives may be used as per the situation. **Classification of drugs used in atherosclerosis:** 1) Hypolipidaemic/ antihyperlipidaemic: a) Statins: Eg. Atorvastatin, Pravastatin, Lovastatin b) Fibrates:Eg. Clofibrate, Ciprofibrate c)Bile acid sequestrants: Colstipol, cholestyramine d) Cholesterol absorption inhibitors: Ezetimibe e)Niacin Other drugs which may be used as per the cause of atherosclerosis are 2) Antiplatelet drugs: Eg. Aspirin, Clopidogrel 3) Anticoagulants: Eg. Warfarin, Heparin 1) Hypolipidaemic/ antihyperlipidemic: These drugs mainly reduce LDL or triglyceride levels. Eg Statins inhibit 3- hydroxy 3-methyl glutaryl coenzyme-A reductase which is the rate limiting step in cholesterol biosynthesis. 2) Antiplatelet drugs: These drugs act by inhibiting enzymes or receptors required for platelet activation, platelet aggregation and /or thrombus formation. 3) Anticoagulants: These drugs act by antagonising the action of vitamin K, inhibiting thrombin, factor xa and some act by inhibiting the conversion of fibrinogen to fibrin and of prothrombin to thrombin and interferes with clumping of platelets.	**3M**

2	b	**Explain advantages and disadvantages of the parenteral route of administration.** **Advantages :** i) It can be employed in unconscious, uncooperative patients. ii) Drugs which irritate the stomach can be given by this route. iii) It avoids drug degradation by digestive juices in GIT ,or by first pass metabolism in the liver. iv) Accuracy of dose v) Has rapid onset of action vi) It is useful in medical emergencies and so a life saving route vii) It is useful in case of vomiting and diarrhoea viii) IV fluids can be life saving in certain cases like coma **Disadvantages** i) Once administered ,difficult to withdraw,hence less safe ii) More expensive iii) Self medication difficult iv) Aseptic technique and skill required, Proper care should be taken to avoid infection	**1.5 M each**
2	c	**Give one example of each:** **i) Thrombolytics:** Eg. Streptokinase,Urokinase,Reteplase,Duteplase **ii) Antiplatelet:** Eg. Aspirin, clopidogrel, ticagrelor, and prasugrel, cilostazol, and dipyridamole. **iii) Haematinics:** Eg. Cynocobalamine, Folic acid, Iron etc.. (Note: any other suitable example can be considered)	**1M Each**
2	d	**Classify cholinergic (Parasympathomimetics) drugs.** **1) Esters of choline** eg. Acetylcholine, Methacholine, Carbachol, Arecholine **2) Inhibitors of cholinesterase enzyme** **a) Reversible anticholinesterases**	**3M**

		i) Naturally occurring eg. Physostigmine ii) Synthetic eg. Neostigmine, Pyridostigmine **b) Irreversible anticholinesterase** eg. DFP (di isopropyl fluorophosphate),ecothiopate OMPA (octamethyl pyrophosphate amide) **3) Naturally occurring cholinomimetic alkaloids** eg. Pilocarpine	
2	**e**	**Define autocoids. Give examples. Explain : physiological role of prostaglandin** Autocoids are diverse substances which are biosynthesized and released by a wide variety of cells and act locally at the site of release to mediate a number of pathological and physiological processes. They are also called local hormones. **OR** Autocoids are local hormones with high biological activity and naturally found in body as active or inactive forms. Ex. Histamine, Serotonin (5 hydroxytryptamine), Bradykinin, Angiotensin, Prostaglandins **Physiological role of Prostaglandin:** **1) Smooth muscles:** Arteriolar smooth muscles are relaxed by PGE2 and PGI2. Prostaglandins promote vasodilation by activating adenylyl cyclase and fall in blood pressure, respiratory smooth muscle is relaxed by PGE1, PGE2, and PGI2. **2) Gastrointestinal tract:** PGE2 is known to inhibit gastric acid secretion and protect gastric and duodenal mucosa. PGE2 and PGF2 cause the contraction of gut muscles.	**1M define with examples. Physiologicale role 2 M**

		3) Platelets aggregation: Prostaglandins effectively inhibit platelet aggregation. **4) Reproductive organs:** PGE2 and PGF2 alpha have marked oxytocic action. 5) Prostaglandins are known to be involved in causing inflammation and pyrexia	
2	**f**	**Define and classify bronchodilators.** These are the pharmacological agents which cause dilatation of bronchi and are used in the treatment of bronchial asthma. Eg. Adrenaline, Isoprenaline, Orciprenaline, Salbutamol, Aminophylline, Ephedrine **Classification of bronchodilators:** 1. Beta2 sympathomimetics a) Short acting beta2 agonists: Salbutamol, Terbutaline b) Long acting beta2 agonists Salmeterol, Formoterol 2) Anticholinergics a) Short acting muscarinic antagonists: Ipratropium bromide b) Long acting muscarininc antagonists: Tiotropium bromide 3) Methylxanthine: Theophylline, Aminophylline **OR** **Bronchodilators :** i) Sympathomimetic: Salbutamol, Terbutaline, Adrenaline, Isoprenaline, Ephedrine ii) Xanthines: Theophylline, Aminophylline	**1M def.2M classification**

		iii) Anticholinergics: Atropine,tiotropium, ipratropium	
2	**g**	**Classify anticonvulsants with examples.** 1. Drugs used in Grand Mal epilepsy: Eg. Phenytoin, Methoin,Phenobarbitone,Carbamazepine 2. Drugs used in Petit mal epilepsy: Eg. Trimethadione, Paramethadione, Phensuximide, Ethosuximide 3. Drugs effective in Psychomotor epilepsy: Eg. Phenytoin, Primidone 4. Drugs used in focal Cortical or Jacksonian Epilepsy: Eg. Phenytoin, Methoin, Phenobarbitone 5. Drugs used in Status epilepticus: Diazepam, Thiopentone **OR** Chemical classification : 1. Hydantoins derivatives :eg Phenytoin, Mephenytoin 2. Barbiturates : eg Phenobarbitone 3. Succinimide :eg Ethosuximide, Phensuximide 4. Oxazolidinediones: eg. Trimethadione, Paramethadione 5. Benzodiazepines : eg Diazepam,Clonazepam 6. Iminostilbene :eg Carbamazepine 7. Aliphatic carboxylic acid : eg. Sodium Valproate	**3M**

		8. Phenyltriazines: eg. Lamotrigine 9. Cyclic GABA analogs: eg. Gabapentin 10. Newer drugs: Topiramate ,Zonisamide	
2	**h**	**Define diuretics and give indications for use of diuretics.** Drugs that increase the volume of urine formation are called diuretics. **OR** Drugs that increase the urine volume and cause loss of electrolytes from the body. **Indications for use of diuretics.** 1) These are used alone or in combination with other drugs in the management of hypertension. 2) These are used for short-term therapy in controlling edema associated with congestive heart failure and cirrhosis. Eg. Thiazide diuretics 3) These drugs are also useful as an adjuvant for management of hypertensive crisis associated with acute pulmonary edema or renal failure. 4) These are used in treatment of poisoning .	**1M def. 2M indications**
2	**i**	**What is insulin used for? What is its route of administration? Mention its adverse effects.** Insulin is used for the treatment of Insulin dependent diabetes mellitus.ie Type I diabetes **Route of administration: Parenteral : Common route is subcutaneous** **Adverse effects:** · Redness, swelling, and itching at the injection site · Changes in the feel of your skin, skin thickening (fat build-up), or a little depression in	**Use 1M,Route 1M, Adverse effect 1M**

		the skin (fat breakdown) · Weight gain · Constipation · Overdose - hypoglycemia	
2	**j**	**Define anthelmintics. Give examples.Explain: Anthelmintics are administered with purgatives.** These are the pharmacological agents which kill or paralyse worms in the body and are used in worm infestation or helminthiasis. Examples: Mebendazole, Albendazole, Niclosamide, Pyarental Pamoate Piperazine Praziquantel. **Use of purgatives is essential with piperazine** Ø Anthelmintics are either wormicidal or wormifugal in action. Ø Thus after killing or paralyzing these worms by anthelmintic agent, these should be expelled out from the intestine. Ø Hence purgatives are advised as supportive treatment with anthelmintics. Ø Thus the combination acts synergistically.	**Def. with eg. 1.5M, Reason 1.5 M**
2	**k**	**Give examples and therapeutic uses of aminoglycoside antibiotics** The aminoglycoside antibiotics are so named because they are composed of amino Sugars connected by glycosidic linkages. e.g. Streptomycin, Gentamicin, Amikacin, Neomycin,kanamycin **Aminoglycosides are used in the following conditions:**	**Eg.1M Uses 2M**

		• Primary and Drug Resistant TB • Severe infections of the abdomen • Urinary tract infection • Bacteremia /septicemia • Endocarditis	
3		**Attempt ALL of the following**	**1M Each**
3	**a**	**Define cardiotonics**. Agents which cause positive inotropic action (increase in force of contraction of the heart) and increase cardiac output	**1M**
3	**b**	**Give 2 examples of Nootropic agents.** Piracetam,pyritinol ,modafinil Caffeine,L-Theanine,Panax Ginseng, Gingko biloba,Brahmi, (Any other 2 correct examples)	**1M**
3	**c**	**Give full form of NSAID** Non Steroidal Antiinflammatory drug.	**1M**
3	**d**	**Mention 2 groups of medicines that come under Biologicals.** Blood or blood products,Vaccines,Antitoxins,Interleukins, Monoclonal antibodies,Stem cells,Gene therapy,Recombinant proteins,Recombinant Nucleic acids (Any other 2 correct groups)	**0.5M EACH**
3	**e**	**Give route of administration of each:** Salbutamol:Oral,IV,Inhalation Neostigmine:Oral,IM,IV,SC	**0.5M EACH**
3	**f**	Chlorzoxazone is used as a Centrally acting muscle relaxant .	**1M**

3	**g**	**Give 2 examples of Antidiarrheal agents**. Kaolin,Pectin,Chalk, Activated charcoal,Atropine,Loperamide,Drotaverine, ORS, Probiotics (Any other 2 correct examples)	**0.5M EACH**
3	**h**	**Name the antidote for Iron poisoning** Deferoxamine	**1M**
3	**i**	**What is Therapeutic Index?** It is the ratio of median lethal dose to median effective dose.(Therapeutic index indicates the relative margin of safety of a drug.) Therapeutic Index TI = LD_{50} / ED_{50}	**1M**
3	**j**	**Mention drug of choice in treatment of Belladona poisoning.** Physostigmine / Neostigmine	**1M**
3	**k**	**Route of administration of halothane is**-Inhalation	**1M**
3	**l**	**Mention two common side effects of antineoplastic agents.** Alopecia,Thrombocytopenia,Bone marrow depression,Anorexia,Leukopenia,Anaemia	**0.5M EACH**
3	**m**	**Give one example of Mydriatic**. Phenylephrine,Adrenaline,Atropine,Homatropine	**1M**
3	**n**	**MAO Inhibitors are used as** -Antidepressants	**1M**
3	**o**	**Mention therapeutic use of each:** Methimazole:Antithyroid agent/In treatment of Hyperthyroidism Metformin: Oral Hypoglycemic agent/In treatment of Diabetes	**0.5M EACH**
3	**p**	**Frusemide is used as**- Diuretic	**1M**
3	**q**	**Triple response is produced by**- Histamine	**1M**
3	**r**	**Mention therapeutic use of each:** Acyclovir: Antiviral agent Fluconazole: Antifungal agent	**0.5M EACH**
3	**s**	**This drug is contraindicated in pregnancy**- Tetracycline	**1M**

3	**t**	**Dale's vasomotor reversal is shown by**-Adrenalin	**1M**