SECTION – I
(Course content)

EMBRYOLOGY
(Demonstration, wherever applicable)
GENERAL EMBRYOLOGY

Lectures: 10 hrs
Practicals: Nil

TOPICS

Introduction: 2 hrs

- Relevance of Embryology to medicine; Grief account of male and female reproductive system; testis and ovary; migration of primordial germ cells into the gonadal ridge; differentiation of gametes
- Ovum, oogenesis, growth of the ovarian follicle, uterine cycle; ovulation
- Sperm, spermatogenesis, spermiogenesis, normal sperm count, seminal fluid, abnormal conditions.
- Sex determination; Principles of family planning

First two weeks of development : 2 hrs

- Fertilization process ; site ; results : in-vitro fertilization; cleavage; blastocyst formation.
- Implantation : types ; formation of decidua; its subdivisions ; abnormal implantation.
- Formation of embryoblast and trophoblast ; development of embryoblast into bilaminar germ disc; development of trophoblast ; formation of cytotrophoblast and syncytiotrophoblast.
- Amniotic membrane ; yolk sac ; extraembryonic mesoderm ; extraembryonic coelome ; connecting stalk ; chorion ; formation of prochordal plate.

Third week of development 1 hr

- Embryoblast ; primitive streak ; primitive node ; formation of intraembryonic mesoderm ; trilaminar germ disc ; notochord ; buccopharyngeal and cloacal membranes ; pericardial bar.
- Trophoblast : secondary yolk sac ; intraembryonic coelome and allantoic diverticulum ; intra embryonic mesoderm and its subdivisions; derivatives of ectoderm, endoderm and mesoderm.

Fourth week of development 1 hr

- Formation of somites ; neural tube ; cephalo – caudal and lateral foldings of the embryo ; establishment of the body form ; formation of the gut and its subdivisions ; vitelline duct

Foetal membranes and the placenta : 2 hrs

- Placenta : formation, functions ; features, types ; circulation ; placental barrier ; abnormalities
  Umbilical cord ; amnion, amniotic fluid, its functions ;
  chorion laevae; decidua ; amniocentesis

Twins : formation, types, conjoint twins, multiple pregnancies 1 hr

Causative factors for congenital malformations 1 hr

SYSTEMIC EMBRYOLOGY

(Course content to include the Functional Embryology and causes of possible congenital anomalies)

Lectures: 27 HI

TOPICS

1. Development of musculoskeletal system 1 hr

2. Development of GIT and respiratory systems: 6 hrs
   - Body cavities and serous membranes
   - Stomach
   - Midgut: rotation of the gut, liver, extrahepatic biliary system
   - Hindgut
   - Diaphragm, spleen and lesser sac
   - Trachea and lungs

3. Development of genitourinary system: 6 hrs
   - Kidney
   - Ureter, Urinary bladder
   - Testis, ovary
   - Descent of gonads
   - Genital ducts
   - External genitalia

4. Development of cardiovascular system: 7 hrs
   - Heart loop and formation of the chambers of the heart
   - Septa and valves of the heart
   - Intraembryonic vessels
   - Major veins
   - Foetal circulation and changes after birth

5. Development of face and pharyngeal apparatus: 4 hrs

- Pharyngeal arches and their derivatives
- Pharyngeal pouches, pharyngeal clefts, first arch syndrome and common birth defects
- Face, oral cavity, soft palate and associated anomalies

6. Development of nervous system: 1 hr
   - Neural tube: brain vesicles and their derivatives, neural crest and its derivatives

7. Development of organs of special senses 1 hr
   - Eye and ear

8. Development of skin and its appendages 1 hr
   - Skin and its appendages
   - Mammary gland and anomalies

9. Development of endocrines 1 hr

SECTION – II
(Course Content under Level – I,II,III)

GENERAL EMBRYOLOGY

	TOPIC	LEVEL 1	LEVEL 2	LEVEL 3
1.	**INTRODUCTION**	• Relevance of Embryology to Medicine • Stages of human life: Prenatal- Zygote, Pre-embryonic, Embryonic & Foetal; Stages of Labour • Critical period of development • Postnatal: Neonatal, Infancy, Childhood, Prepubertal, Pubertal, Adolescence, Adult • Ontogeny; Trimester; Viability; Abortion; Miscarriage; MTP; Conceptus; Abortus • Terms of reference: Cranial, Rostral, Caudal, Dorsal, Ventral, Medial, Lateral		• Ontogeny in relation to Phylogeny; • History of Embryology

2.	**GAMETOGENESIS**	• Menstrual cycle; Ovarian cycle;LMP & EDD; Oogenesis & ovulation; Ovum • Spermatogenesis; Spermiogenesis; Sperm; Normal sperm count; Seminal fluid; Abnormal conditions; • Capacitation • Germ cell transport and fertilization; Acrosome reaction Zona reaction • Contraception • Sex determination	• Reference to genetics; • Abnormal gametogenesis; • Abnormal germ cells; Morphology • Abnormal chromosomal content; • Biological significance; • Conception	• Abnormalities that could occur during mitosis & meosis • Fertility & sterility-investigations thereof • Sex selection • Surrogate motherhood • Social significance of sex ratio; • Ethics & responsibility
3.	**FIRST TWO WEEKS**	• Fertilization; • Implantation, Decidua and decidual reaction • Abnormal sites of implantation • Cleavage, Blastocyst • Inner & outer cell mass • Epiblast & hypoblast • Bilaminar & trilaminar discs • Amniotic membrane, Yolk sac; Connecting stalk; Chorion • Prochordal plate • Extraembryonic mesoderm • Primary chorionic villi and placentation • Oral & buccopharyngeal membranes	• Mosaicism; Chimera • Spontaneous abortion • Consequence of abnormal implantation • Chorionic gonadotrophins • Pregnancy test • Inhibition of implantation	• Pregnancy wastage • Appreciating dangers of abnormal implantation • Corrective methods • False positive and false negative pregnancy tests: Reasons for the same
3.	**3.THIRD WEEK**	• Gastrulation; Primitive streak • Basic steps for the formation of notochord; • Neurulation- Neural tube & its fate; Neural crest • Neural tube defects-spina bifida, Meningomyelocoele, Anencephaly	• Nucleus pulposus • Sacrococcygeal teratomas	• Signs of pregnancy during the first trimester • Frame of body-poles, Axes, Symmetry • Dilatation & curettage procedure • Suction curettage • Alphafetoprotein levels

		• Development of somites • Intraembryonic coelome; CVS • Foetal membranes: Chorioonic villi, Amnion, Yolk sac, Allantois • Inductive significance of structures • Intraembryonic medsoderm & its subdivisions • Cephalocaudal folding and establishment of the body form; Formation of the GIT; Vitelline duct • Derivatives of th germ layers • Pharyngeal arches		
4.	**FOETAL MEMBRANES**	• Formation, functions and fate of foetal membranes • Placenta- types; types of cord attachments; physiological functions; Fetomaternal circulation; • Placental circulation • Twinning: Monozygotic and dizygotic	• Role of placental hormones • Uterine growth • Parturition • Multiple pregnancy	• Post-labour examination of placenta • Abnormal multiple pregnancies- complications • Variety of uses of amniotic membrane • Trophobatic tumours: benign and malignant • Rh incompatability • Haemolytic disease of the new born • Erythroblastosis foetalis • Teratogenic influences
4.	**THE FOETAL PERIOD**	• Growth of the foetus in general with reference to weight & major features • Maternal- foetal correlation (Pregnancy changes in mother)	• Estimation of foetal age • Concept of prematurity • Body segments- proportion • Tissue differentiation	• Concept of ‘large’ and ‘small’ babies • Small for age growth • Cytogenetics • Chorionic villus biopsy & Amniocentisis

			and function	• Other methods of foetal monitoring and their hazards
5.	**CONGENITAL MALFORMATIONS**	• Causative factors • Mechanisms	• Mechanism with brief manifestations and genetic basis • Review of general embryology; 'Critical period of development' • Teratogens • Multifactorial inheritance methods available to correct or palliate – eg. In utero surgery, genetic engineering; Stem cell transplants	
6.	**BODY CAVITIES, MESENTERIES & THE DIAPHRAGM**	• Subdivisions of the coelomic cavity • Related parts: cardiogenic area, septum transversum • Somatopleura, splanchnopleura • Mesenteries: formation, functions & fate • Diaphragm	• Enumeration of congenital anomalies • Diaphragmatic hernias	• Clinical presentation: Neonatology, • Respiratory distress syndrome • Herniation • Intrauterine surgery to correct malformations

SECTION – II
(Course Content under Level – I,II,III)

SYSTEMIC EMBRYOLOGY

S.No	TOPIC	LEVEL 1	LEVEL 2	LEVEL 3
1.	**MUSCULOSKELETAL SYSTEM**	• Limb buds • Fate, Rotation of the limb buds	• Congenital anomalies: Amelia, Phocomelia etc.	
2.	**CARDIOVASCULAR SYSTEM**	• Angiogenesis • Heart loop and formation of the chambers of the	• Enumeration of veins, abnormalities • Correlation with	• Clinical features • Recent development:

		heart; septa & valves • Truncus- formation & fate • Intraembryonic vessels: normal & anomalies arterial system • Major veins: normal & anomalies • Foetal circulation & changes at birth • ASDs, VSDs,PDA & Fallots tetrology	gross anatomy abnormal development • Lymphatic system	prosthetic valves, grafting, Transplantation; • Surgical correction
3.	**DIGESTIVE (ALIMENTARY) SYSTEM**	• Body cavities & serous membrane • Foregut & its derivatives; omental bursa • Midgut: Derivatives, rotation of the gut; Meckel's diverticulum; Liver & extrahepatic biliary system • Pancreas • Spleen • Portal vein Hindgut; Cloaca and its derivatives	• Malformations- review • Congenital hypertrophic pyloric stenosis; • Atresia, Omphalocoele; • Hernia • Malformations: Fistulae, situs inversus;Non-rotation, reversed & mixed rotation	• Clinical presentation in premature births and neonatal period
4.	**RESPIRATORY SYSTEM**	• Tracheobronchial diverticulum • Development of larynx, trachea, bronchi & lungs • Tracheo-oesophageal fistula	• Other anomalies	• Respiratory distress syndrome • Premature births and consequent necessary care
5.	**UROGENITAL SYSTEM**	• Kidneys, ureter, urinary bladder • Cloaca- Urinary bladder and urethra • Suprarenal gland • Gonads: testis & ovary • Descent of	• Enumeration of congenital anomalies and their causes • Ambiguous genitalia & hermaphroditism • Remnants and vestiges of the	• Clinical presentation & visualization in the living • Hernia, hydrocoele • Relavance to Fornsic Medicine

		gonads • Associated glands • Mesonephric duct and paramesonephric systems • Uterine tube, Uterus and vagina • External genitalia	ducts & tubules	
6.	**FACE & PHARYNGEAL APARATUS**	• Pharyngeal arches, pouches and cleft: derivatives and fate • Development of face, oral cavity, palate: Normal development & associated anomalies • First arch syndrome	• Common anomalies and syndromes associated with the pharyngeal arches	•
7.	**NERVOUS SYSTEM**	• Neural tube and brain vesicles • Ventricular system • Neural crest • Hypophysis cerebri • Peripheral nervous system: somatic and autonomic • Principles of neurobiotaxis; Correlation with gross and histogenetic neuroanatomy • Functional components correlation with spina bifida • Anencephaly, hydrocephalus, • Functional components of peripheral nerves • Shortening of the spinal cord and		• Sequence of myelination • Genetic & teratogenic factors in neural tube defects

		the basis of lumbar puncture		
8.	**ORGANS OF SPECIAL SESNSES**	• Eye: Embryologic source of each component and the adnexa • Ear: Internal ear-membranous and bony labyrinth; Middle ear and External ear: Normal development and common anomalies	• Common anomalies of the eye: Retinal detachment; Congenital glaucoma; • Coloboma iridis, Congenital cataract and Aphakia	• Genetics and teratology especially Rubella; Toxoplasmosis "TORCH" test; Clinical stetction and small functional problems of the eye and ear
9.	**INTEGUMENTARY SYSTEM**	• Skin, Pilo-sebaceous unit; Tooth as modified dermal papillae • Nail, sweat glands, mammary glands • Anomalies of mammary gland	• Congenital anomalies with reference to pigment, sweat glands, vessels, nerves, lymphatics	• Genetics and teratology • Clinical syndromes