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 Hrs

**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
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

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<thead>
<tr>
<th>TOPIC</th>
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<tbody>
<tr>
<td>1. INTRODUCTION</td>
<td>Relevance of Embryology to Medicine</td>
<td>Ontogeny in relation to Phylogeny; History of Embryology</td>
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<tr>
<td></td>
<td>Stages of human life: Prenatal- Zygote, Pre-embryonic, Embryonic &amp; Foetal; Stages of Labour</td>
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<td>Critical period of development</td>
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<td>Postnatal: Neonatal, Infancy, Childhood, Prepubertal, Pubertal, Adolescence, Adult</td>
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<td>Ontogeny; Trimester; Viability; Abortion; Miscarriage; MTP; Conceptus; Abortus</td>
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<td>Terms of reference: Cranial, Rostral, Caudal, Dorsal, Ventral, Medial, Lateral</td>
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<td>2. GAMETOGENESIS</td>
<td>• Menstrual cycle; Ovarian cycle; LMP &amp; EDD; Öogenesis &amp; 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</td>
<td>• Reference to genetics; • Abnormal gametogenesis; • Abnormal germ cells; Morphology • Abnormal chromosomal content; • Biological significance; • Conception</td>
<td>• Abnormalities that could occur during mitosis &amp; meiosis • Fertility &amp; sterility-investigations thereof • Sex selection • Surrogate motherhood • Social significance of sex ratio; • Ethics &amp; responsibility</td>
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<tr>
<td>3. FIRST TWO WEEKS</td>
<td>• Fertilization; • Implantation, Decidua and decidual reaction • Abnormal sites of implantation • Cleavage, Blastocyst • Inner &amp; outer cell mass • Epiblast &amp; hypoblast • Bilaminar &amp; trilaminar discs • Amniotic membrane, Yolk sac; Connecting stalk; Chorion • Prochordal plate • Extraembryonic mesoderm • Primary chorionic villi and placentation • Oral &amp; buccopharyngeal membranes</td>
<td>• Mosaicism; Chimera • Spontaneous abortion • Consequence of abnormal implantation • Chorionic gonadotrophins • Pregnancy test • Inhibition of implantation</td>
<td>• Pregnancy wastage • Appreciating dangers of abnormal implantation • Corrective methods • False positive and false negative pregnancy tests: Reasons for the same</td>
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<td>3. 3.THIRD WEEK</td>
<td>• Gastrulation; Primitive streak • Basic steps for the formation of notochord; • Neurulation- Neural tube &amp; its fate; Neural crest • Neural tube defects- spina bifida, Meningomyelocele, Anencephaly</td>
<td>• Nucleus pulposus • Sacrococcygeal teratomas</td>
<td>• Signs of pregnancy during the first trimester • Frame of body-poles, Axes, Symmetry • Dilatation &amp; curettage procedure • Suction curettage • Alphafetoprotein levels</td>
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### 4. **FOETAL MEMBRANES**

- Development of somites
- Intraembryonic coelome; CVS
- Foetal membranes: Chorioionic villi, Amnion, Yolk sac, Allantois
- Inductive significance of structures
- Intraembryonic mesoderm & its subdivisions
- Cephalocaudal folding and establishment of the body form; Formation of the GIT; Vitelline duct
- Derivatives of germ layers
- Pharyngeal arches

- 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 incompatibility
- 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 & Amniocentesis
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<th>S.No</th>
<th>TOPIC</th>
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<tbody>
<tr>
<td>1.</td>
<td>MUSCULOSKELETAL SYSTEM</td>
<td>• Limb buds</td>
<td>• Congenital anomalies: Amelia, Phocomelia etc.</td>
<td>• Clinical presentation: Neonatology,</td>
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<td>• Fate, Rotation of the limb buds</td>
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<td>Respiratory distress syndrome</td>
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<td>• Herniation</td>
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<td>• Intrauterine surgery to correct</td>
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<td>2.</td>
<td>CARDIOVASCULAR SYSTEM</td>
<td>• Angiogenesis</td>
<td>• Enumeration of veins, abnormalities</td>
<td>• Clinical features</td>
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<td>• Heart loop and formation of the</td>
<td>• Correlation with</td>
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<td>chambers of the</td>
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SECTION – II  
(Course Content under Level – I,II,III)  
SYSTEMIC EMBRYOLOGY
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<thead>
<tr>
<th>3. DIGESTIVE SYSTEM</th>
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<td>Body cavities &amp; serous membrane</td>
<td>Malformations-review</td>
<td>Clinical presentation in premature births and neonatal period</td>
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<tr>
<td>Foregut &amp; its derivatives; omental bursa</td>
<td>Congenital hypertrophic pyloric stenosis; Atresia, Omphalocele; Hernia</td>
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<td>Midgut: Derivatives, rotation of the gut; Meckel’s diverticulum; Liver &amp; extrahepatic biliary system</td>
<td>Malformations: Fistulae, situs inversus; Non-rotation, reversed &amp; mixed rotation</td>
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<td>Pancreas</td>
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<td>Portal vein Hindgut; Cloaca and its derivatives</td>
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<th>4. RESPIRATORY SYSTEM</th>
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<tr>
<td>Tracheobronchial diverticulum</td>
<td>Other anomalies</td>
<td>Respiratory distress syndrome</td>
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<tr>
<td>Development of larynx, trachea, bronchi &amp; lungs</td>
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<td>Premature births and consequent necessary care</td>
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<td>Tracheo-oesophageal fistula</td>
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<th>5. UROGENITAL SYSTEM</th>
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<tr>
<td>Kidneys, ureter, urinary bladder</td>
<td>Enumeration of congenital anomalies and their causes</td>
<td>Clinical presentation &amp; visualization in the living</td>
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<td>Cloaca- Urinary bladder and urethra</td>
<td>Ambiguous genitalia &amp; hermaphroditism</td>
<td>Hernia, hydrocoele</td>
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<td>Suprarenal gland</td>
<td>Remnants and vestiges of the</td>
<td>Relavance to Fornsic Medicine</td>
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<td>Gonads: testis &amp; ovary</td>
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| **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 nervous system  
• 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 |
| 8. | **ORGANS OF SPECIAL SENSES** | **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 |