

End Semester Examination, Dec. 2016  
B. Tech.– Second Semester  
BASICS OF AERONAUTICAL ENGINEERING (AE-201)

Time: 3 hrs.

Max Marks: 100

No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Answer any ten questions:

- a) What is a sounding rocket? What have been the applications of Rohini class rockets?
- b) What are the fixed wing, rotary wing, and the mixed fixed-rotary wing airplanes?
- c) How does lift-coefficient vary with increase in flap deflection? Explain with the help of  $c_l - \alpha$  plots.
- d) Draw the axis system typically used in the study of aircraft stability and control. Show the occurrence of various forces and moments.
- e) Based on the airfoil theory of propeller write the equation for thrust force generated by a propeller type engine.
- f) What are the principle advantages of a centrifugal compressor vis-à-vis an axial flow compressor?
- g) What are stressed skin and pressure bulkhead?
- h) What different types of external loads are applied on an aircraft structure?
- i) What is manifold pressure? How is it measured, and what is its unit?
- j) What is the difference between indicated air speed and true air speed?
- k) Which are the essential services that are operated by a hydraulic system in a general aviation aircraft?
- m) Name the types of hydraulic oils which have been in use in aircraft hydraulic systems. Highlight their relative merits and demerits. 2 × 10

PART-A

- Q.2
  - a) Define a flight vehicle. What is the difference between an aerostatic craft and an aerodynamic craft? Give examples of each type. What is a surface effect craft? 10
  - b) List the differentiating features of a transport aircraft, a fighter aircraft, a helicopter and a spacecraft. 10
- Q.3
  - a) Why do we need flaps for aircrafts? Describe different types of flaps with proper sketches. 12
  - b) Explain how induced drag is generated and why is it known as lift-dependent drag? 8
- Q.4
  - a) What is the difference between a centrifugal flow type compressor and an axial flow type compressor? Explain with the help of suitable sketch of each type. 12
  - b) Distinguish between a turboprop engine and a turbo-shaft engine. What are their applications in the aviation field? 8

PART-B

- Q.5
  - a) Discuss various structural members used in the construction of a wing. How does each of them contribute in taking the aerodynamic and static loads? 10
  - b) What are the traditional metallic materials used in aircraft structures? What are the key material properties that are pertinent to maintenance cost and structural performance? 10
- Q.6
  - a) Explain the working of a pressure altimeter. 8

**P.T.O.**

- b) Explain, with the help of block diagrams, the operation of a basic transmitter and a basic receiver circuit used for radio communication purpose. 12

- Q.7 a) What is a sequence valve and describe different types of sequence valves that are generally found in use in the aircraft hydraulic system. 10
- b) Explain the basic fuel system requirements. What are the basic types of aviation fuels used? Draw a system diagram of basic fuel system used in an aircraft and explain its operation. 10

End Semester Examination, Dec. 2016  
B. Tech. –Third Semester  
ELEMENTS OF AERONAUTICAL ENGINEERING (AE-301)

Time: 3 hrs

Max Marks: 100

No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Answer any five of the following:

- a) Where the following structural members located in an aircraft and what are their purposes?
  - i) Ribs.
  - ii) Bulkheads.
  - iii) Firewall.
  - iv) Spars.
- b) Name any two aircraft configurations that are used to achieve vertical take-off and landing. How is the vertical take-off achieved by Harrier fighter jet aircraft? Give an example of any other vertical take-off aircraft.
- c) What types of loads a main undercarriage is subjected to during landing? Explain briefly.
- d) Draw  $c_l$  vs  $\alpha$  curves for a cambered airfoil and a symmetrical airfoil and explain the difference.
- e) What is a band width? What is the frequency range of the following communication systems?
  - i) HF system.
  - ii) VHF system.
  - iii) UHF communication systems.
- f) Explain the function of a sequence valve that is used in an undercarriage operation system. 4x5

PART-A

- Q.2
  - a) Explain the features of a transport aircraft, a fighter aircraft, a helicopter and a spacecraft. 10
  - b) Explain how turning of a helicopter to left or right is achieved. How do we achieve take-off of a glider aircraft? What is a powered glider? 10
- Q.3
  - a) What do you understand by high lift devices? Why do we require high lift devices? Explain with sketches, various types of high lift devices. 10
  - b) Explain the function of various primary control surfaces that are used to control the aircraft during flying. 10
- Q.4
  - a) Explain the usefulness of a fixed pitch propeller and a variable pitch propeller. 8
  - b) Explain with the help of suitable sketches the construction and operation of a turbojet engine, a fan-jet engine and a solid propellant rocket. 12

PART-B

- Q.5 Discuss the loads that are borne by the following structural members of an aircraft:
  - a) Fuselage.
  - b) Wings.
  - c) Aircraft skin.
  - d) Engine pylon. 5x4

- Q.6 a) With the help of suitable block diagrams, describe a basic radio system that is used for communication in an aircraft. 10  
b) Explain the features of an Instrument Landing System. 10
- Q.7 a) Describe a basic hydraulic system, having essential components that can be used in an aircraft. Explain the function of the following components:  
i) Filter with a by-pass valve.  
ii) Selector valve.  
iii) Actuator.  
iv) Pressure relief valve. 10  
b) What is the difference between a single action and a double action hand pump? 5  
c) For which services a pneumatic system is used as a standby system against a hydraulic system? 5

End Semester Examination, Dec. 2016  
B. Tech. – Fourth Semester  
AERODYNAMICS-I (AE-401)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Answer any five of the following:

- a) Explain the concept and criteria of dynamic similarities.
- b) Write a short note on velocity potential and stream function.
- c) Explain the phenomena of downwash.
- d) Write a short note on vortex panel numerical method.
- e) Explain the physical significance of displacement thickness.
- f) Explain the methods to prevent boundary layer separation.

4 × 5

PART-A

- Q.2 a) Write a short note on 'Mach number regime'. 6  
b) Derive a relation between moment, lift and drag using normal force and axial force. Explain the coefficient for the same. 14
- Q.3 Derive the Kutta-Joukowski theorem using the flow over a rotating cylinder. Explain the significance and importance of Kutta-Joukowski theorem. 20
- Q.4 a) Derive an expression for induced drag using Prandtl's classical lifting line theory. 10  
b) Derive an expression for induced drag for elliptical wing by lift distribution over it. Explain how it is different from general lift distribution? 10

PART-B

- Q.5 Explain in detail the method of numerical non-linear lifting-line. Using it explain the method and steps to calculate circulation over an airfoil. 20
- Q.6 Derive the Blasius solution for the flow over a flat plate. Find an expression for friction coefficient, boundary layer thickness, displacement thickness and momentum thickness with the help of it. 20
- Q.7 Write short notes on the following:  
a) Maximizing the lift coefficient for a single element airfoil.  
b) Different types of flaps and its effect.  
c) Fresh boundary layer and its effects.  
d) The aerodynamics of a normal and racing cars.  
e) Gurney flaps and its difference from movable flaps. 4 × 5

End Semester Examination, Dec. 2016  
B. Tech. – Fourth Semester  
AIRCRAFT STRUCTURES-I (AE-402A)

Time: 3 hrs

Max Marks: 100

No. of pages: 2

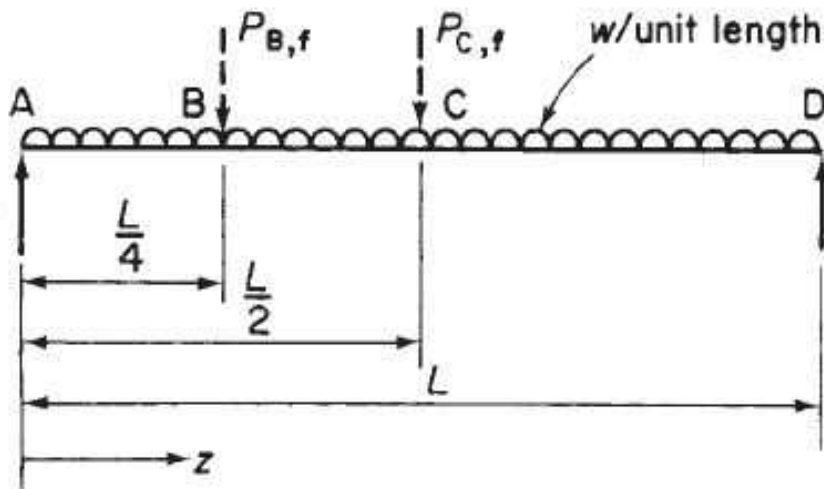
Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

- Q.1
- Define 'longitudinal' and 'lateral strain'.
  - Define 'indeterminate structures'.
  - Explain the role of longerons and stressed skin structure in fuselage design.
  - State the St. Venant's principle.
  - Write true stress in terms of engineering stress.
  - Define 'strain energy'.
  - What do you mean by limit load and ultimate load of any structure?
  - What do you mean by shear flow?
  - Explain Maxwell reciprocal theorem.
  - State the importance of V-n diagram.

2×10

PART-A

- Q.2 Calculate the vertical displacements of the quarter and mid-span points B and C of the simply supported beam of length L and flexural rigidity EI loaded beam as shown in the figure using energy method.



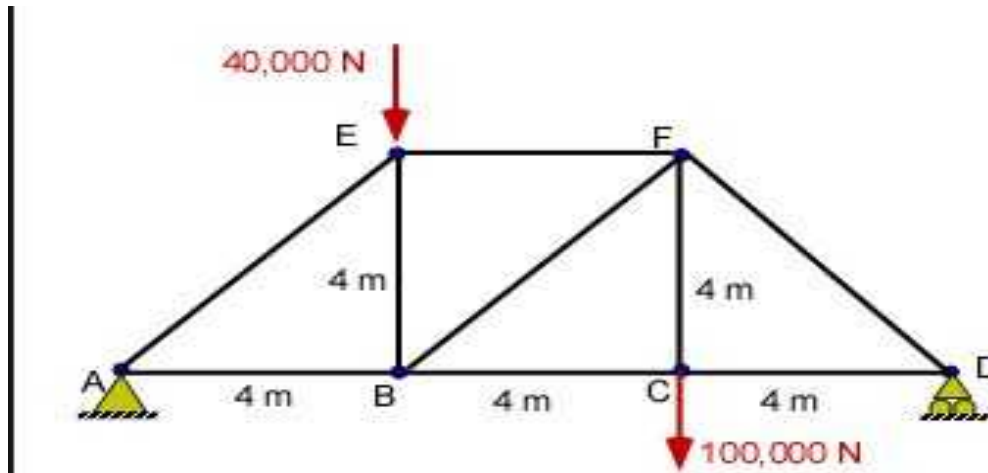
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- Q.3 An aluminium alloy bar of circular cross sectional area A and length L is subjected to axial tensile force P. Determine:-
- Axial deformation
  - Change in diameter D
  - Change in volume V
- Evaluate all above quantity for numerical values  $P=60 \text{ KN}$ ,  $d=25 \text{ mm}$ ,  $L=3 \text{ m}$ ,  $E=70 \text{ GPa}$ , poisson's ratio = 0.3.
- Q.4
- Find the deflection curve for cantilever beam with uniformly distributed load.
  - What is shear centre? Calculate the position of the shear centre of the thin-walled channel section. The thickness t of the walls is constant.

10

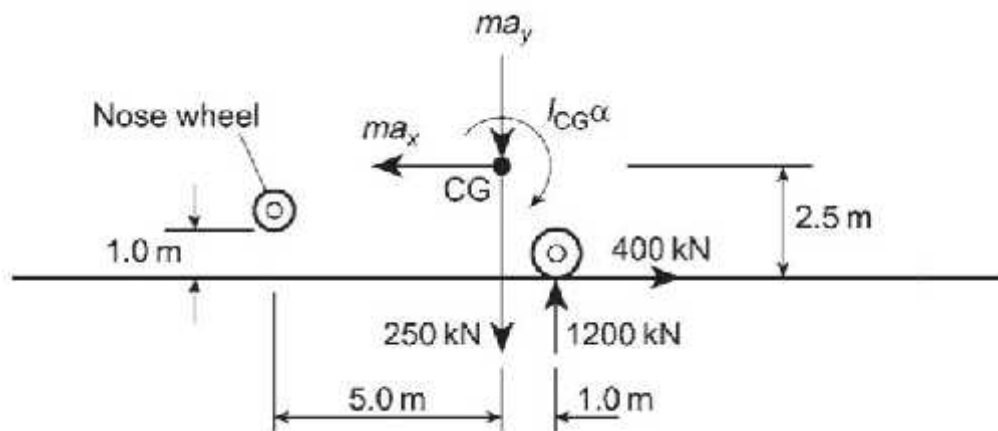
## PART-B

- Q.5 Determine the forces in all members in given truss in terms of Young's modulus of elasticity ( $E$ ) and cross section area ( $A$ ). (Use any one of the two methods of truss analysis)



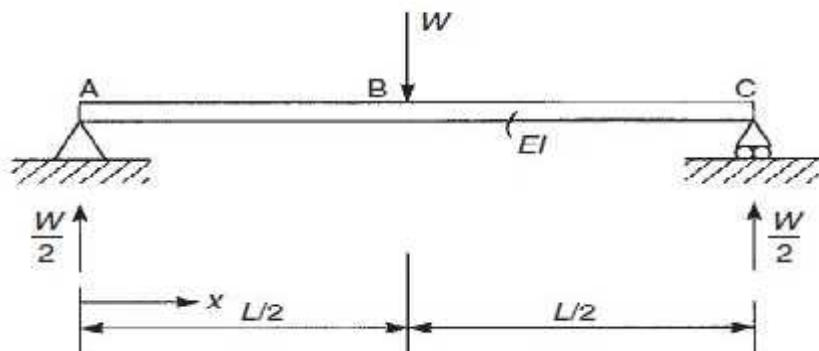
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- Q.6 An aircraft having a total weight of 250kN and a tricycle undercarriage lands at a vertical velocity of 3.7m/s, such that the vertical and horizontal reactions on the main wheels are 1200kN and 400kN respectively; at this instant the nose wheel is 1.0m from the ground, as shown in figure. If the moment of inertia of the aircraft about its CG is  $5.65 \times 10^8 \text{ N s}^2 \text{ mm}$ , determine the inertia forces on the aircraft, the time taken for its vertical velocity to become zero and its angular velocity at this instant.



20

- Q.7 a) Determine the rotation, i.e. the slope, of the beam ABC shown in figure at A.



15

b)

What would be dilatation of an element in tri-axial stress? Thus find bulk modulus of elasticity.

W

5



End Semester Examination, Dec. 2016  
B. Tech.–FourthSemester  
AIRCRAFT PROPULSION-I (AE-403)

Time: 3 hrs

Max Marks: 100

No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

- Q.1
- Draw a sketch of separate exhaust turbofan engine.
  - Define pressure ratio of a compressor.
  - Explain Otto cycle.
  - What happens to power developed by engine as altitude increases?
  - What is incompressible flow?
  - What do you mean by 'thermal efficiency'?
  - Why does shock occur?
  - Define total pressure.
  - What is ideal momentum theory?
  - What are ramjet engines?

2x10

PART-A

- Q.2
- Write a descriptive and diagrammatic note on turbofan engine. 10
  - What do you mean by mechanical efficiency of turbojet engine? 4
  - Define and explain the terms by-pass ratio air/fuel ratio ( $f$ ), compressor pressure ratio, mechanical efficiency of turbine. Write their typical values. 6
- Q.3
- Explain 2- stroke engine. 5
  - Explain Brayton cycle with P-V diagram. 5
  - A Brayton cycle operating at compressor pressure rise of 3 bars from 1 bar at 25°C and with maximum temperature being 650° C. Determine compressor work, turbine work and thermal efficiency. 10
- Q.4
- Air is compressed isentropically from  $P_1=100$  KPa,  $T_1=150^\circ\text{C}$ , to  $P_2=1$  Mpa. Calculate  $T_2$  and  $\dots_2$  Take  $\gamma = 1.4$ ,  $R=287$  J/Kg.K, and assume that gas is calorically perfect. 10
  - Write area Mach Number relation. Explain its application for supersonic diffuser and nozzle. 5
  - Draw  $P_{t2}/P_{t1}$  curve for normal shock. 5

PART-B

- Q.5
- Write expression for  $F_{n/uninstalled}$  for turbojet engine. Explain each term. 5
  - An air breathing engine has flight velocity of  $M=0.85$  at altitude where speed of sound is 300m/sec. The air mass flow rate is 50kg/sec. Calculate ram air drag for this engine. 5
  - Explain specific thrust and propulsive efficiency. A turbojet engine is flying at 200m/sec. The product of combustion achieve an exhaust velocity of 900m/sec. Estimate engine propulsive efficiency. 10
- Q.6
- What is a gas generator? Write a note on inlet of a gas turbine engine. 10
  - A multistage axial flow compressor has mass flow rate of 50kg/s and total pressure ratio of 35. Compressor polytropic efficiency  $e_c = 0.9$ . The inlet flow condition to compressor is  $T_{t2}=288$  K and  $P_{t2}=100$  kPa. Take adiabatic flow with  $\gamma = 1.4$  and  $C_p=1004$  J/kg.K. Find:
    - Compressor exit total temperature  $T_{t3}$
    - Compressor adiabatic efficiency  $\eta_c$
    - Compressor shaft power
- 10
- Q.7
- Explain blade element theory for turboprop engine and airscrew pitch. 10

b) Write a note on Scramjet engine and ideal ramjet cycle.

10

End Semester Examination, Dec. 2016  
B. Tech.–Third/Fourth Semester  
AIRCRAFT MATERIALS (AE-404)

Time: 3 hrs.

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

- Q.1
- a) Define 'normalizing' and 'casehardening'.
  - b) Explain Brinell hardness.
  - c) What is alloy steel?
  - d) Write properties of nickel.
  - e) What will be SAE numbering system for nickel steel?
  - f) What will be percentage of carbon in hypo-eutectoid?
  - g) What are hardenable chromium steels?
  - h) Write composition of inconel.
  - i) Write properties of heat treatable alloys (wrought alloys).
  - j) Why do we need composite materials?
- 2×10

PART-A

- Q.2
- a) What are engineering factors that affects choice of materials for different parts of airplane? 10
  - b) Explain temperature variation over body of an aircraft(concord) with proper sketch. 10
- Q.3
- a) Write heat treatment steps for medium carbon steel and high carbon steel. 10
  - b) What are different allotropic forms of pure iron? Draw and explain temperature vs % of carbon curve showing different critical points. 10
- Q.4
- a) Write different types of corrosion and its prevention method. 7
  - b) What is fatigue? Explain different types of fatigue loading with examples. 7
  - c) Classify corrosion resisting steel and write property of each category. 6

PART-B

- Q.5
- a) What is Alclad aluminium alloy? 6
  - b) Write a note on magnesium alloy in reference to aircraft construction and its uses. 7
  - c) What is composition of bronze? Write uses of gun metal and phosphor bronze. 7
- Q.6
- a) How are nickel alloys important for aircraft structures? What is composition of K-monel and state its uses? 7
  - b) What is Red Brass? What are its applications? 6
  - c) Explain season cracking. 7
- Q.7
- a) What are the functions of a matrix in a composite material? 7
  - b) Write properties of carbon fibre. 6
  - c) What are alumina fibres? Write its application. 7

End Semester Examination, Dec. 2016  
B. Tech.–Fifth Semester  
AERODYNAMICS-II (AE-501)

Time: 3 hrs.

Max Marks: 100

No. of pages: 4

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Answer any five of the following:

- a) Differentiate between the terms characteristic Mach number and critical Mach number.
- b) When is a flow considered compressible? What is isentropic compressibility?
- c) How does Rankine-Hugoniot equation differ from an isentropic relation  $p_2/p_1 = (\dots_2/\dots_1)^x$ ? Explain the difference through suitable plots of both.
- d) What do you understand by supersonic compression by turning?
- e) Explain briefly the intersection of right- and left-running shock waves.
- f) Define drag divergence Mach number and sound barrier.

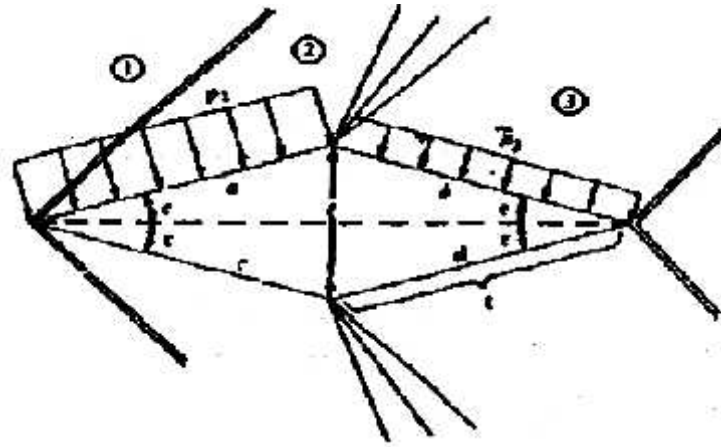
4 × 5

PART-A

- Q.2 a) Define thickness chord ratio and percentage camber. If a circle of radius  $c$  displaced horizontally by distance  $be'$  and vertically by distance ' $b\beta$ ' from the origin of the Oxy plane is transformed into a cambered airfoil profile given in the  $\zeta$ -plane by  
 $\xi = 2b \cos \theta$  and  
 $H = 2be (1 + \cos \theta) \sin \theta + 2b\beta \sin^2 \theta$ ,  
determine the thickness cord ratio and percentage camber of the airfoil. 12
- b) Define conformal transformation. For the transformation  $\zeta = z + b^2 / z$ , where  $b$  is a constant, find out the length ratio. 8
- Q.3 a) Why do we need to study high angle of attack aerodynamics? 5
- b) What do you understand by calorically perfect gas? Describe the governing equations for inviscid, compressible flow. 15
- Q.4 a) Derive the Rayleigh's Pitot tube formula and discuss how velocity of a supersonic flow can be measured using this formula. 10
- b) Consider a flow with a pressure and temperature of 1 atm and 288 K. A Pitot tube is inserted into this flow and measures a pressure of 3.645 atm. What is the velocity of the flow? 10

PART-B

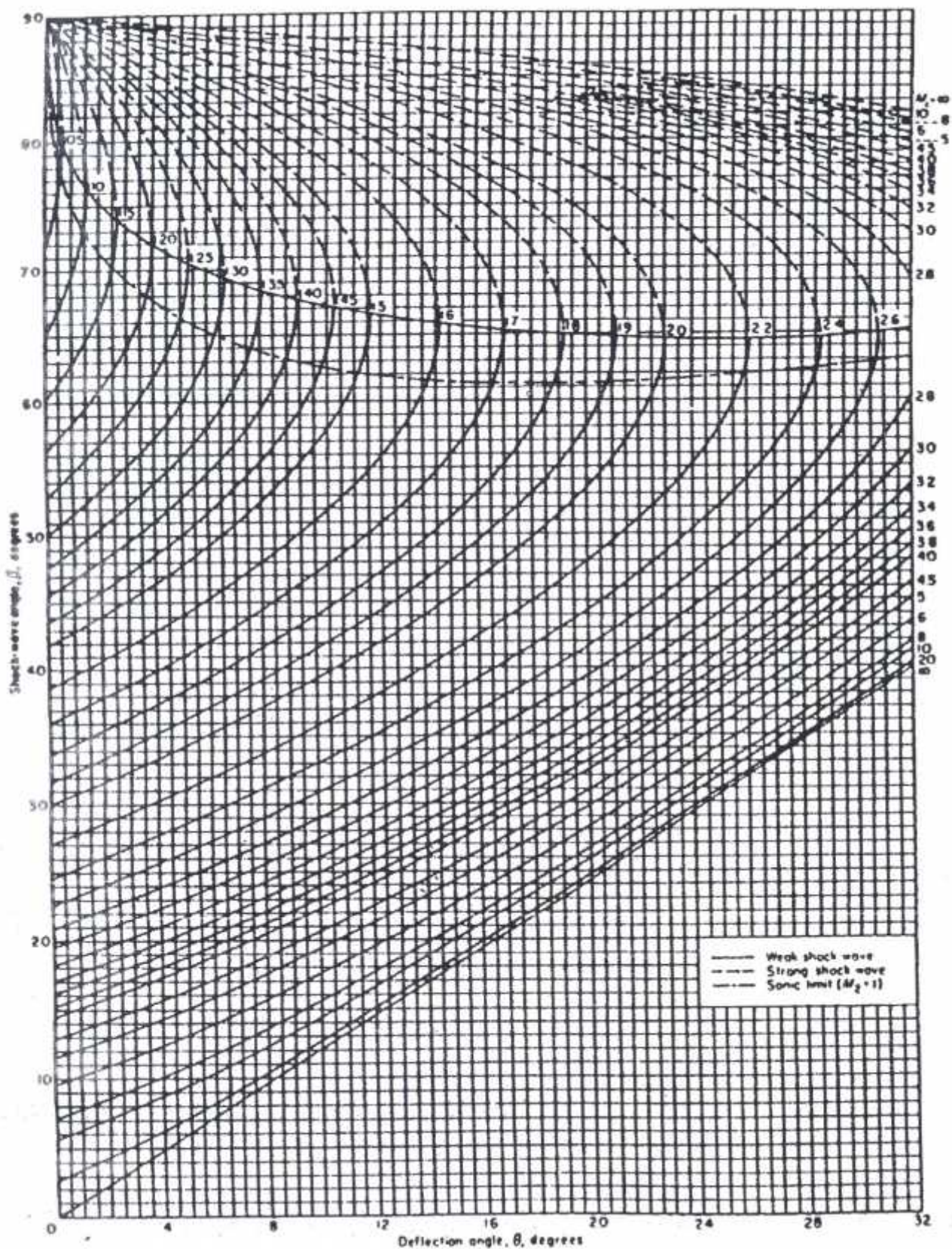
- Q.5 a) For a uniform supersonic flow at Mach number  $M_1$  along a surface having sudden deflection  $\theta$  resulting in generation of an oblique shock wave having wave angle  $\beta$ , derive a relationship between  $\theta$ ,  $\beta$ , and  $M_1$ . Discuss the plots between  $\theta$  and  $\beta$  for various values of  $M_1$ . 10
- b) A supersonic flow at  $M = 1.58$  and  $p_1 = 1$  atm expands around a sharp corner. If the pressure downstream of the corner is 0.13 atm, calculate the deflection angle of the corner. 10
- Q.6 a) Consider a diamond-wedge airfoil such as shown in the figure with a half angle  $\varepsilon = 12^\circ$ . The airfoil is at an angle of attack  $\alpha = 15^\circ$  to a Mach 2.5 freestream. Calculate the lift and wave-drag coefficients for the airfoil.



Diamond-wedge airfoil at  $0^\circ$  angle of attack in a supersonic flow. 15

- b) Define Prandtl-Glauert rule and show how the compressibility correction can be applied to obtain  $C_p$ ,  $C_l$  and  $C_m$  for compressible flows. 5

- Q.7 a) What do you understand by the compatibility equations along the characteristic lines? 5
- b) Considering the compatibility relations along C- and C+ characteristics starting from points where flow properties are known, discuss the steps of the method of characteristics used to obtain the flow properties at downstream points for a two-dimensional, inviscid, steady flow. 15





## PRANDTL-MEYER FUNCTION AND MACH ANGLE

M	$\theta$	$\mu$	M	$\theta$	$\mu$
0.1000 +01	0.0000	0.9000 +02	0.1600 +01	0.1604 +02	0.3157 +02
0.1020 +01	0.1257 +00	0.7864 +02	0.1680 +01	0.1663 +02	0.3104 +02
0.1040 +01	0.3104 +00	0.7406 +02	0.1760 +01	0.1722 +02	0.3053 +02
0.1060 +01	0.6367 +00	0.7063 +02	0.1700 +01	0.1781 +02	0.3003 +02
0.1080 +01	0.9680 +00	0.6781 +02	0.1720 +01	0.1840 +02	0.2955 +02
0.1100 +01	0.1236 +01	0.6538 +02	0.1740 +01	0.1898 +02	0.2908 +02
0.1120 +01	0.1735 +01	0.6323 +02	0.1760 +01	0.1956 +02	0.2862 +02
0.1140 +01	0.2160 +01	0.6131 +02	0.1780 +01	0.2015 +02	0.2818 +02
0.1160 +01	0.2607 +01	0.5955 +02	0.1800 +01	0.2073 +02	0.2775 +02
0.1180 +01	0.3074 +01	0.5794 +02	0.1820 +01	0.2130 +02	0.2733 +02
0.1200 +01	0.3558 +01	0.5644 +02	0.1840 +01	0.2188 +02	0.2692 +02
0.1220 +01	0.4057 +01	0.5505 +02	0.1860 +01	0.2245 +02	0.2652 +02
0.1240 +01	0.4569 +01	0.5375 +02	0.1880 +01	0.2302 +02	0.2613 +02
0.1260 +01	0.5093 +01	0.5253 +02	0.1900 +01	0.2359 +02	0.2576 +02
0.1280 +01	0.5627 +01	0.5138 +02	0.1920 +01	0.2415 +02	0.2539 +02
0.1300 +01	0.6170 +01	0.5028 +02	0.1940 +01	0.2471 +02	0.2503 +02
0.1320 +01	0.6721 +01	0.4925 +02	0.1960 +01	0.2527 +02	0.2468 +02
0.1340 +01	0.7279 +01	0.4827 +02	0.1980 +01	0.2583 +02	0.2433 +02
0.1360 +01	0.7844 +01	0.4733 +02	0.2000 +01	0.2638 +02	0.2400 +02
0.1380 +01	0.8413 +01	0.4644 +02	0.2050 +01	0.2693 +02	0.2367 +02
0.1400 +01	0.8987 +01	0.4558 +02	0.2100 +01	0.2747 +02	0.2335 +02
0.1420 +01	0.9565 +01	0.4477 +02	0.2150 +01	0.2801 +02	0.2304 +02
0.1440 +01	0.1013 +02	0.4398 +02	0.2200 +01	0.2854 +02	0.2274 +02
0.1460 +01	0.1073 +02	0.4323 +02	0.2250 +01	0.2907 +02	0.2244 +02
0.1480 +01	0.1132 +02	0.4251 +02	0.2300 +01	0.2959 +02	0.2215 +02
0.1500 +01	0.1191 +02	0.4181 +02	0.2350 +01	0.3011 +02	0.2186 +02
0.1520 +01	0.1249 +02	0.4114 +02	0.2400 +01	0.3062 +02	0.2158 +02
0.1540 +01	0.1309 +02	0.4049 +02	0.2450 +01	0.3113 +02	0.2130 +02
0.1560 +01	0.1368 +02	0.3987 +02	0.2500 +01	0.3163 +02	0.2103 +02
0.1580 +01	0.1427 +02	0.3927 +02	0.2550 +01	0.3213 +02	0.2076 +02
0.1600 +01	0.1486 +02	0.3868 +02	0.2600 +01	0.3263 +02	0.2049 +02

M	$\theta$	$\mu$	M	$\theta$	$\mu$
0.2700 +01	0.4362 +02	0.2174 +02	0.5600 +01	0.8303 +02	0.1070 +02
0.2750 +01	0.4469 +02	0.2132 +02	0.5700 +01	0.8280 +02	0.1010 +02
0.2800 +01	0.4575 +02	0.2092 +02	0.5800 +01	0.8258 +02	0.0952 +02
0.2850 +01	0.4678 +02	0.2054 +02	0.5900 +01	0.8236 +02	0.0895 +02
0.2900 +01	0.4779 +02	0.2017 +02	0.6000 +01	0.8214 +02	0.0839 +02
0.2950 +01	0.4878 +02	0.1981 +02	0.6100 +01	0.8193 +02	0.0784 +02
0.3000 +01	0.4976 +02	0.1947 +02	0.6200 +01	0.8172 +02	0.0730 +02
0.3050 +01	0.5071 +02	0.1914 +02	0.6300 +01	0.8151 +02	0.0677 +02
0.3100 +01	0.5165 +02	0.1882 +02	0.6400 +01	0.8130 +02	0.0625 +02
0.3150 +01	0.5257 +02	0.1851 +02	0.6500 +01	0.8109 +02	0.0573 +02
0.3200 +01	0.5347 +02	0.1821 +02	0.6600 +01	0.8088 +02	0.0522 +02
0.3250 +01	0.5435 +02	0.1792 +02	0.6700 +01	0.8067 +02	0.0471 +02
0.3300 +01	0.5522 +02	0.1764 +02	0.6800 +01	0.8046 +02	0.0421 +02
0.3350 +01	0.5607 +02	0.1737 +02	0.6900 +01	0.8025 +02	0.0371 +02
0.3400 +01	0.5691 +02	0.1710 +02	0.7000 +01	0.8004 +02	0.0322 +02
0.3450 +01	0.5773 +02	0.1685 +02	0.7100 +01	0.7983 +02	0.0273 +02
0.3500 +01	0.5853 +02	0.1660 +02	0.7200 +01	0.7962 +02	0.0225 +02
0.3550 +01	0.5932 +02	0.1636 +02	0.7300 +01	0.7941 +02	0.0177 +02
0.3600 +01	0.6009 +02	0.1613 +02	0.7400 +01	0.7920 +02	0.0130 +02
0.3650 +01	0.6085 +02	0.1590 +02	0.7500 +01	0.7899 +02	0.0083 +02
0.3700 +01	0.6160 +02	0.1568 +02	0.7600 +01	0.7878 +02	0.0037 +02
0.3750 +01	0.6233 +02	0.1547 +02	0.7700 +01	0.7857 +02	0.0000 +02
0.3800 +01	0.6304 +02	0.1526 +02	0.7800 +01	0.7836 +02	0.0000 +02
0.3850 +01	0.6375 +02	0.1505 +02	0.7900 +01	0.7815 +02	0.0000 +02
0.3900 +01	0.6444 +02	0.1486 +02	0.8000 +01	0.7794 +02	0.0000 +02
0.3950 +01	0.6512 +02	0.1466 +02	0.8100 +01	0.7773 +02	0.0000 +02
0.4000 +01	0.6578 +02	0.1448 +02	0.8200 +01	0.7752 +02	0.0000 +02
0.4050 +01	0.6644 +02	0.1429 +02	0.8300 +01	0.7731 +02	0.0000 +02
0.4100 +01	0.6708 +02	0.1412 +02	0.8400 +01	0.7710 +02	0.0000 +02
0.4150 +01	0.6771 +02	0.1394 +02	0.8500 +01	0.7689 +02	0.0000 +02
0.4200 +01	0.6833 +02	0.1377 +02	0.8600 +01	0.7668 +02	0.0000 +02
0.4250 +01	0.6894 +02	0.1361 +02	0.8700 +01	0.7647 +02	0.0000 +02
0.4300 +01	0.6954 +02	0.1345 +02	0.8800 +01	0.7626 +02	0.0000 +02
0.4350 +01	0.7013 +02	0.1329 +02	0.8900 +01	0.7605 +02	0.0000 +02
0.4400 +01	0.7071 +02	0.1314 +02	0.9000 +01	0.7584 +02	0.0000 +02
0.4450 +01	0.7128 +02	0.1299 +02	0.9100 +01	0.7563 +02	0.0000 +02
0.4500 +01	0.7183 +02	0.1284 +02	0.9200 +01	0.7542 +02	0.0000 +02
0.4550 +01	0.7238 +02	0.1270 +02	0.9300 +01	0.7521 +02	0.0000 +02
0.4600 +01	0.7292 +02	0.1256 +02	0.9400 +01	0.7500 +02	0.0000 +02
0.4650 +01	0.7345 +02	0.1242 +02	0.9500 +01	0.7479 +02	0.0000 +02
0.4700 +01	0.7397 +02	0.1228 +02	0.9600 +01	0.7458 +02	0.0000 +02
0.4750 +01	0.7448 +02	0.1215 +02	0.9700 +01	0.7437 +02	0.0000 +02
0.4800 +01	0.7499 +02	0.1202 +02	0.9800 +01	0.7416 +02	0.0000 +02
0.4850 +01	0.7548 +02	0.1189 +02	0.9900 +01	0.7395 +02	0.0000 +02
0.4900 +01	0.7597 +02	0.1176 +02	1.0000 +01	0.7374 +02	0.0000 +02
0.4950 +01	0.7645 +02	0.1166 +02			
0.5000 +01	0.7692 +02	0.1154 +02			
0.5100 +01	0.7738 +02	0.1131 +02			
0.5200 +01	0.7784 +02	0.1109 +02			
0.5300 +01	0.7829 +02	0.1088 +02			
0.5400 +01	0.7874 +02	0.1067 +02			

**End Semester Examination, Dec. 2016**  
**B. Tech.(Aeronautical) —Fifth Semester**  
**AIRCRAFT PROPULSION-II (AE-502)**

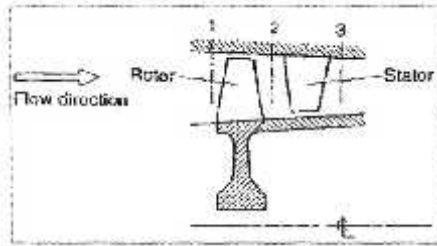
Time: 3 hrs.

Max Marks: 100

No. of pages: 2

Note: Attempt **FIVE** questions in all; **Q.1** is compulsory. Attempt **ANYTWO** questions from **PART-A** and **TWO** questions from **PART-B**. Each question carries equal marks.

- Q.1 Answer the following briefly:
- Define stagnation properties of a fluid flow. Define isentropic efficiency of compressor and turbine.
  - Define SFC and specific thrust. How are the SFC and fuel/air ratio related?
  - Explain the phenomenon of rotating stall and surge in a compressor.
  - What is the effect of compressibility on the performance of centrifugal compressor?
  - Define isentropic efficiency of compressor and jet nozzle.
  - What is work done factor for an axial compressor stage? What is a typical value of work done factor?
  - Name the pollutants that are possibly emitted with the exhaust of an engine. What steps are taken to reduce the noise level of aircraft jet engines?
  - Draw a T-s diagram for an axial compressor stage as shown below:



- Draw velocity diagrams for an axial flow turbine stage from entry to the exit from the stage.
- Explain the performance of a turbine with the help of plots of turbine characteristics. **2×10**

### **PART-A**

- Q.2 Write the basic equations for Rayleigh flow and Fanno flow. Discuss the main features of Rayleighflow and Fanno flow with the help of T-s diagram. **20**
- Q.3 Determine the specific thrust for a simple turbojet engine, having the following component performance at the design point at which the cruising speed Mach number is 0.75 and altitude is 11000 m (whereas perISA,  $p_a = 0.2270 \text{ bar}$ ,  $T_a = 216.8 \text{ K}$ ,  $a = 295 \text{ m/s}$ ):
- Compressor pressure ratio: 8.5  
 Turbine inlet temperature: 1250 K  
 Combustion pressure loss,  $\Delta p_b$ : 4% of compressor delivery pressure.  
 Isentropic efficiencies are:  $\gamma_i = 0.93$   $\gamma_c = 0.87$   $\gamma_t = 0.90$   $\gamma_j = 0.95$   $\gamma_m = 0.99$   $\gamma_b = 0.98$ . **20**
- Q.4 Explain the salient features and principle of operation of centrifugal compressor with the help of suitable sketches. Derive the expressions for work done and stagnation pressure ratio. **20**

### **PART-B**

- Q.5
- Explain with help of plots the variation of flow angles from root to tip of blade. **5**
  - How do you estimate the number of stages required in an axial compressor? **5**
  - Explain with the help of plots the variation of degree of reaction from the blade root to blade tip. **10**
- Q.6
- Explain the methods of flame stabilization that have been used in actual designs of combustion chambers in the past. **10**
  - What are the primary, secondary and tertiary flows? Explain their function in the combustion process. **10**
- Q.7
- Derive expression for work done, total-to-total efficiency, total-to-static efficiency, temperature drop coefficient, degree of reaction and flow coefficient for a turbine stage. **10**
  - Explain the procedure followed to determine the flow angles for nozzle and rotor blades for degree of reaction as 0.5. **10**



# End Semester Examination, Dec. 2016

## B. Tech.—Fifth Semester FLIGHT MECHANICS-I (AE-504)

Time: 3 hrs.

Max Marks: **100**

No. of pages: **2**

Note: Attempt **FIVE** questions in all; **Q.1** is **compulsory**. Attempt **ANYTWO** questions from **PART-A** and **TWO** questions from **PART-B**. Each question carries equal marks.

(The common data for the numerical problems is given in the starting. Make use of given data values only, any other assumed values will not be credited.)

Common Data for the Numerical Problems:

- Value of acceleration due to gravity:  $9.81 \text{ m/s}^2$ .
- Ambient density at sea-level:  $1.225 \text{ Kg/m}^3$ .
- Ambient density at 5 Km altitude:  $0.7364 \text{ Kg/m}^3$ .
- Ambient density at 10 Km altitude:  $0.4135 \text{ Kg/m}^3$ .
- Speed of Sound at 15 degrees C:  $340 \text{ m/s}$ .

Q.1 Answer the following questions (**ANY TEN**):

- What is drag polar?
- State and derive the hydrostatic equation.
- How the airspeed of an airplane is measured? Explain the mechanism.
- Define calibrated airspeed.
- What is dynamic pressure?
- What is profile drag?
- State a condition in which load factor has maximum value.
- What are effects of wing dihedral?
- What are the conditions for maximum range for a jet engine aircraft?
- What are the assumptions taken in finite wing theory?
- What are the conditions for maximum endurance of a piston-engine powered airplane? **2×10**

### **PART-A**

Q.2 On a certain day the pressure at sea level is 758 mm of mercury ( $101059 \text{ N/m}^2$ ) and the temperature is  $23^\circ\text{C}$ . The temperature is found to fall linearly with height to  $-59^\circ\text{C}$  at 13 Km and after that it remains constant up to 20 Km. Calculate the pressure, density and kinematic viscosity at 8 Km and 16 Km altitude. **20**

Q.3 Explain various type of flaps used in aircraft with their uses. **20**

Q.4 A jet airplane with a weight of 450,000 N and wing area of  $110 \text{ m}^2$  has  $C_{Lmax}$  with flaps is 2.4. Obtain the take-off distance to 15 m screen height and the time taken for it.

Given that:

$$V_1 = 1.12 V_s, V_2 = 1.22 V_1,$$

$C_L$  during ground run is 1.15,

Drag polar with landing gear and flaps deployed is  $C_D = 0.044 + 0.05 C_L^2$ ,

Thrust variation during take-off can be approximated as:  $T = 1,28,500 - 0.085 V^2$ ; where  $V$  is in Km/hr. and  $T$  is in Newton's, and take-off takes place from a level, dry concrete runway ( $\sim = 0.02$  at sea level). **20**

### **PART-B**

Q.5 a) A piston engine aircraft is climbing at a constant Mach number of 0.6. Obtain the rate of climb when it is climbing at an altitude of 5 km. The following data has been given about the airplane:

$$W = 54,000 \text{ N},$$

$S = 17 \text{ m}^2$ ,  
 $C_D = 0.017 + 0.055 C_L^2$ ,  
 and thrust available at 5 km altitude = 13,000 N. **10**

- b) Consider a jet airplane with 20% of its weight as fuel fraction. It starts the cruise climb at an altitude of 11 Km. What will be the altitude at the end of cruise climb ( $h_f$ )? Assuming  $V = 220 \text{ m/s}$ ,  $TSFC = 0.6$  and  $(C_L/C_D) = 19$ , estimate the range in cruise climb ( $R_{cc}$ ).  
 What is the angle of climb ( $\chi_{cc}$ ) in cruise climb? **10**

- Q.6 a) An airplane stalls at  $M=0.25$  at sea level. What will be the Mach number and equivalent airspeed when it stalls at 5 km altitude? Compare the thrust required to maintain level flight near stall at the two altitudes. Assume the weight of the airplane to be same at the two altitudes. **10**

- b) Obtain the maximum speed and minimum speed in steady level flight at sea-level for the following airplane:  
 $W = 36,250 \text{ N}$ ,  
 $S = 28.0 \text{ m}^2$ ,  
 $C_D = 0.032 + 0.043 C_L^2$ ,  
 $BHP = 503 \text{ kW}$ ,  
 Propeller efficiency = 82%,  
 $C_{Lmax} = 1.5$  **10**

- Q.7 An airplane with a weight of 156,960 N and a wing area of  $49 \text{ m}^2$  has a drag polar given by  $C_D = 0.017 + 0.06 C_L^2$ . It accelerates under standard sea level conditions from a velocity of 100 m/s to 220 m/s. Obtain the distance covered and the time taken during the acceleration, assuming the thrust output to remain roughly constant at 53,950 N. **20**

**End Semester Examination, Dec. 2016**  
**B. Tech.—Fifth / Sixth Semester**  
**AIRCRAFT STRUCTURES-II (AE-503A)**

Time: 3 hrs.

Max Marks: **100**

No. of pages: **3**

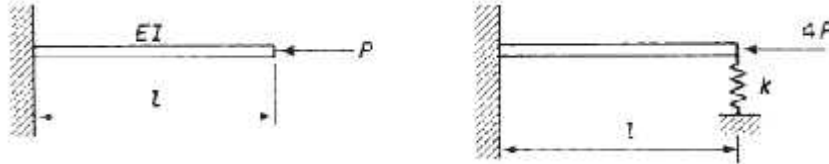
Note: Attempt **FIVE** questions in all; **Q.1** is **compulsory**. Attempt **ANYTWO** questions from **PART-A** and **TWO** questions from **PART-B**. Each question carries equal marks.

- Q.1
- What type of columns are designed to prevent material elastic failure?
  - Define 'slenderness ratio'.
  - State the principle of the stationary value of the total complementary energy.
  - Differentiate between 'tangent modulus equation' and 'reduced modulus equation'.
  - Define 'buckling'.
  - Differentiate between 'local' and 'global co-ordinate system'.
  - Derive the stiffness matrix for a single elastic spring.
  - What are the implications of structural idealization?
  - Define 'margin of safety'.
  - Why bolt holes are always slightly larger than the bolt diameter?

**2×10**

**PART-A**

- Q.2 A uniform column of length  $l$  and bending stiffness  $EI$  is built-in at one end and free at the other and has been designed so that its lowest flexural buckling load is  $P$  (see figure below):



Subsequently it has to carry an increased load, and for this it is provided with a lateral spring at the free end. Determine the necessary spring stiffness  $k$  so that the buckling load becomes  $4P$ .

Data given:  $EI \frac{d^2 u}{dx^2} = -Pu$  and general solution  $u = A \cos px + B \sin px$ .

**20**

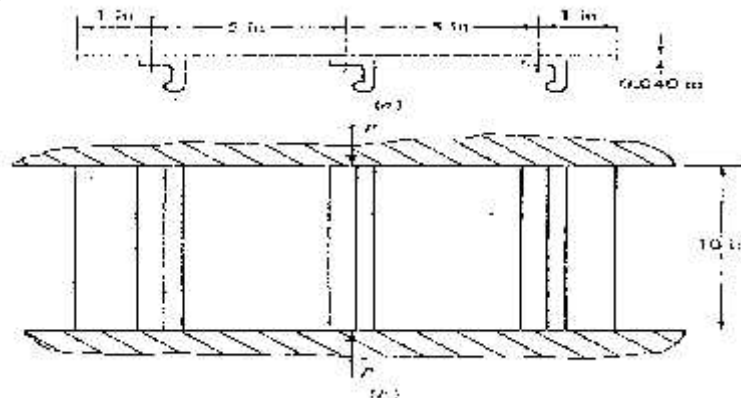
- Q.3 The sheet stringer panel shown in figure below is loaded in compression by means of rigid members. The sheet is assumed to be simply supported at the loaded ends and at the rivet lines and is to be free at the sides. Each stringer has an area of  $0.1 \text{ m}^2$ . Assume  $E=10,300,000 \text{ lb/in}^2$  for the sheet and stringers. Find the total compressive load  $P$ :

- When sheet buckles first?
  - When the stringer stress  $\sigma_c$  is  $15,000 \text{ lb/in}^2$ ?
  - When the stringer stress  $\sigma_c$  is  $35,000 \text{ lb/in}^2$ ?
- $K=3.62$  (given)

**7**

**7**

**6**



- Q.4 An initially untwisted rectangular wing of semi-span 's' and chord 'c' has its flexural axis normal to the plane symmetry, and is of constant cross-section with torsional rigidity  $GJ$ . The aerodynamic centre  $ec$  ahead of the flexural axis, the lift-coefficient slope is 'a' and the pitching

moment coefficient at zero lift is  $C_{m,0}$ . At speed  $V$  and the air density the wing root incidence from the zero lift is  $\alpha_0$ .

Using simple strip theory i.e. ignoring downwash effects, show that the incidence at a section distant  $y$  from the plane of symmetry is given by:

$$r + \alpha = \left( \frac{C_{m,0}}{ea} + r_0 \right) \frac{\cos \alpha (s - y)}{\cos \alpha s} = \frac{C_{m,0}}{ea}$$

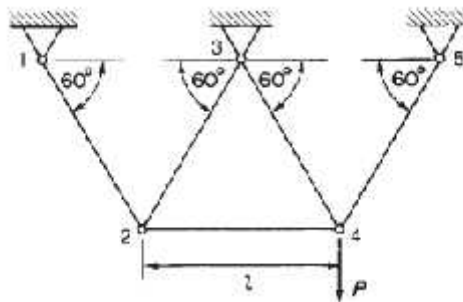
Where:

$$\alpha^2 = \frac{ea \frac{1}{2} V^2 c^2}{GJ}$$

Hence, assuming  $C_{m,0}$  to be negative, find the condition giving the speed at which the lift would be reduced to zero. 20

### **PART-B**

- Q.5 Form the matrices required to solve completely the plane truss shown in the figure below and determine the force in member 24. All members have equal axial rigidity  $EA$ .

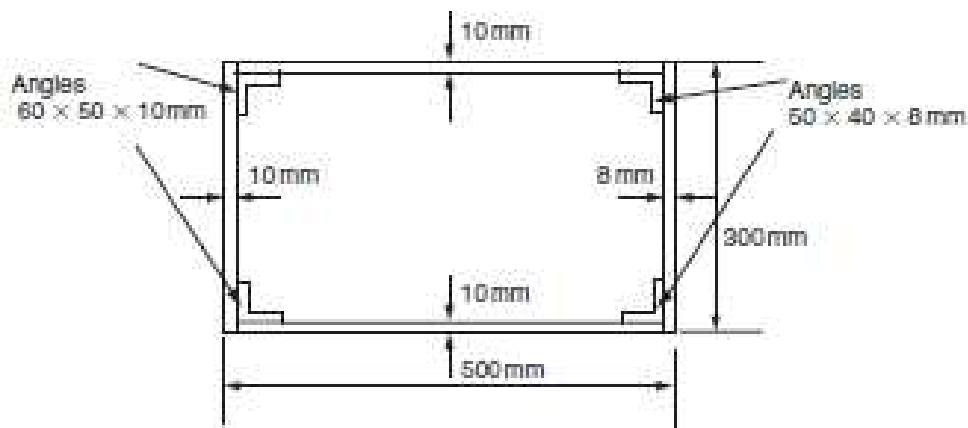


Given data:

$$\begin{Bmatrix} F_{x,1} \\ F_{y,1} \\ F_{x,2} \\ F_{y,2} \\ F_{x,3} \\ F_{y,3} \end{Bmatrix} = \begin{bmatrix} [k_{11}] & [k_{12}] & [k_{13}] \\ [k_{21}] & [k_{22}] & [k_{23}] \\ [k_{31}] & [k_{32}] & [k_{33}] \end{bmatrix} \begin{Bmatrix} u_1 \\ u_2 \\ u_3 \end{Bmatrix}$$

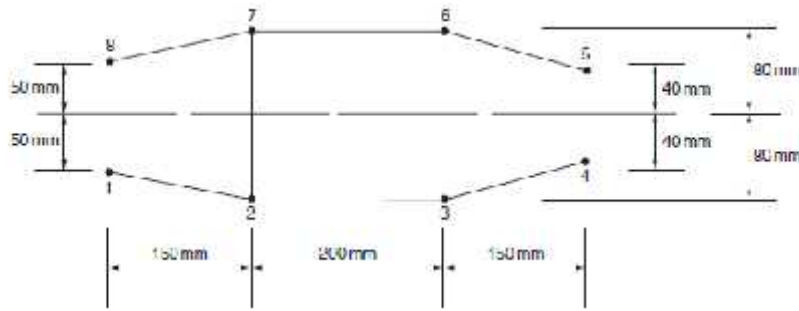
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- Q.6 a) Idealize the box section shown in figure below into an arrangement of direct stress carrying booms positioned at the four corners and panels which are assumed to carry only shear stresses. Hence determine the distance of the shear centre from the left hand web. 10



10

- b) The beam section shown in the figure below has been idealized into an arrangement of direct stress carrying booms and shear stress only carrying panels. If the beam section is subjected to a vertical shear load of 1495N through its shear centre, booms 1,4,5 and 8 each have an area of  $200\text{mm}^2$  and booms 2,3,6 and 7 each have an area of  $250\text{mm}^2$  determine the shear flow distribution and the position of shear centre.



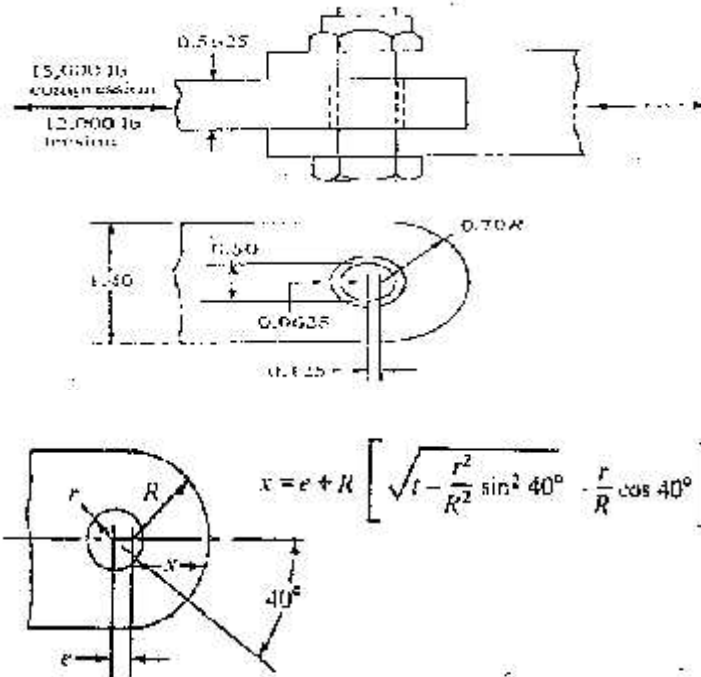
Given data:

$$q_s = - \left( \frac{S_x I_{xy} - S_y I_{xy}}{I_{xx} I_{yy} - I_{xy}^2} \right) \left( \int_0^s t_D y ds + \sum_{r=1}^n B_r x_r \right) \quad B_1 = \frac{t_D b}{6} \left( 2 + \frac{t_2}{t_1} \right)$$

$$- \left( \frac{S_x I_{yy} - S_y I_{xy}}{I_{xx} I_{yy} - I_{xy}^2} \right) \left( \int_0^s t_D y ds + \sum_{r=1}^n B_r y_r \right) \quad B_2 = \frac{t_D b}{6} \left( 2 + \frac{t_1}{t_2} \right)$$

10

- Q.7 The fitting shown in figure 7.a is made of a 2014 aluminum forging, for which  $\sigma_{at} = 65,000$ ,  $\tau_a = 39,000$  and  $\sigma_{abr} = 98,000 \text{ lb/in}^2$ . The bolt and bushing are made of steel for which  $\sigma_{at} = 125,000$ ,  $\tau_a = 75,000$  and  $\sigma_{abr} = 175,000 \text{ lb/in}^2$ . The fitting resists limit or applied loads of 15,000-lb compression and 12,000-lb tension. A fitting factor of 1.2 and a bearing factor of 2.0 are used. Find the margins of safety for the fitting for various types of failure



For bolt and bushing (made of steel):

$$\sigma_{at} = 1.25 \times 10^6 \text{ lb/in}^2, \quad \sigma_{abr} = 1.75 \times 10^6 \text{ lb/in}^2, \quad \tau_a = 0.75 \times 10^6 \text{ lb/in}^2.$$

For fitting (made of aluminum):

$\sigma_{at} = 0.65 \times 10^6 \text{ lb/in}^2$ ,  $\sigma_{abr} = 0.98 \times 10^6 \text{ lb/in}^2$ ,  $\tau_a = 0.39 \times 10^6 \text{ lb/in}^2$ . Resisting load of fitting in compression is  $0.15 \times 10^6 \text{ lb}$  and  $0.12 \times 10^6 \text{ lb}$  in tension. Fitting factor is 1.2 and bearing factor is 2.0

20

End Semester Examination, Dec. 2016  
B. Tech.–Fifth / Sixth Semester  
AIRCRAFT SYSTEMS (AE-505)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

- Q.1    a) Explain the primary and secondary flight controls.  
      b) What is the difference between 'normal and hydraulic power systems'?  
      c) How does the Anti-skid system work?  
      d) Explain briefly H.P. and L.P. oxygen cylinders.  
      e) Explain how the humidity is controlled in an aircraft. 4x5

PART-A

- Q.2    a) Explain the fly by wire and fly by light systems. 10  
      b) Explain a typical elevator control system in detail. 10
- Q.3    a) What do you understand by skidding? Explain how it can be avoided. 7  
      b) Sketch the tyre section and explain the purpose of different layers. 7  
      c) Explain the checks for contamination of hydraulic system. 6
- Q.4    a) Explain the fuelling and defueling of aircraft and safety precautions to be observed during this procedure. 10  
      b) Describe the various types of fuel tanks used on aircraft. 10

PART-B

- Q.5    a) Describe the conditioned air flow system in the aircraft. 10  
      b) Describe the water separator and temperature control system used in the aircraft. 10
- Q.6    a) Explain the oxygen supply system used in aircraft. 10  
      b) Describe the system for oxygen charging, purging and leak checking. 10
- Q.7    a) Explain the solid state oxygen generator in detail. 10  
      b) Describe the precautions to be observed while working on oxygen system. 10

End Semester Examination, Dec.2016  
B. Tech. – Sixth Semester  
FLIGHT MECHANICS-II (AE-603)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Answer any five of the following:

- a) Explain the concept of 'neutral points' and its importance for static longitudinal stability.
- b) Write a short note on 'spoiler control over a wing and its effect'.
- c) How does acceleration affect the static longitudinal stability?
- d) Explain the concept of 'rudder lock'. Also explain how dorsal fin helps to prevent it.
- e) Explain the concept of 'dihedral effect'. How is it affected by the flap deflection?
- f) Explain the difference between body axis and wind axis. 4×5

PART-A

- Q.2 a) Explain the two conditions for the aircraft's static longitudinal stability? 4  
b) Derive the expression for overall static longitudinal stability of an aircraft. Explain how tail contributes for this. 16
- Q.3 a) Explain the details of hinge moment parameters with the help of graphs and expressions. 10  
b) Explain the concept of 'floating and restoring tendencies'. 6  
c) Write a short note on 'aerodynamic balancing'. 4
- Q.4 a) Explain the limits of an aircraft's center of gravity for static longitudinal stability. Also show and explain the effect of ground, power and maneuvering over it. 5  
b) Derive an expression for stick force gradients in unaccelerated flight. Also explain the concept of trim condition. 15

PART-B

- Q.5 a) Explain the static directional stability with the help of  $C_n$  vs  $\psi$  graph. 4  
b) Derive an expression for static directional stability rudder fixed for different wing tip shape, wing position and propeller configuration. 16
- Q.6 a) Explain the static lateral stability with the help of  $C_l$  vs  $\psi$  graph. 4  
b) Explain and estimate the lateral control power. Explain why it cannot be used for practical purpose. 16
- Q.7 Derive the equation of longitudinal motion with the help of general equation of motion for an aircraft. 20

# End Semester Examination, Dec. 2016

## B. Tech. – Sixth Semester AIRCRAFT DESIGN (AE-604)

Time: 3 hrs

Max Marks:100

No. of pages:2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Attempt to answer (any five) parts:

- Draw the flight envelope for a supersonic aircraft with proper labeling.
- Which aspects a manufacturer should consider during spending of money for building an aircraft?
- List out the different types of drag acting on aircraft.
- How does placement of engines effect aircraft performance and design? Give your views about it.
- Define: Oleo and Drag Brace and explain with suitable sketches.
- What are the different groups of a UAV? Explain each.

4×5

### PART-A

- Q.2
- What are the basic classifications of aircraft? Describe them in detail.
  - What is the design wheel? Draw it. Explain the various phases of aircraft design with a diagram/flow-chart.
  - What are the main sources of drag? What is induced drag? How do finite wings generate induced drag?
  - What is an UAV? Give its classification and applications.

5×4

- Q.3
- Define: Weight in respect of an aircraft. How does estimation of weight affect aircraft design? Give the steps for weight estimation for the following:
    - Passenger aircraft.
    - Combat aircraft.
    - Rescue aircraft.
    - Cargo aircraft.
  - Compute the various weight fractions for flight segment of an anti-submarine warfare aircraft having the following parameters:  
Loiter=3 hours  
Max. distance = 2778 km  
Equipment weight=10000 lb  
Crew weight = 800 lb  
Mach = 0.6  
Consider all sea-level properties for calculations.

10

10

- Q.4
- Draw the critical load diagram for L1011. Also give the load table mentioning all the loads acting-on an aircraft.
  - Explain Maneuver loads. Draw its V-n Diagram and explain it in brief.
  - Explain Gust loads. Draw its V-n Diagram and explain it. Finally draw the combined V-n Diagram and explain it.

8

6

6

### PART-B

- Q.5
- Which are the factors that influence the volume considerations in fuselage design? Describe each in detail.
  - Write brief notes on: i). Wing Sweep ii). Taper Ratio iii). Twist iv) Dihedral.
  - Give the BM and SF for a rectangular wing, elliptical wing and a delta wing.

6

10

4



Q.6 a) Describe the oleo shock absorber arrangement? Explain why oleo performance is better than other shock absorber arrangements? Show how landing gear stroke length is independent of aircraft weight?

10

b) Give the different types of landing gear arrangement and briefly describe each with diagram? Describe how landing gears are housed in an aircraft.

10

Q.7 Do vertical tail, horizontal tail and wing design using below parameters?

i) Cruise Mach Number = 1.2

ii) Cruise Altitude = 30,000 ft

iii) Wing Area = 200 ft<sup>2</sup>

iv) Aspect Ratio for vertical tail and horizontal tail = 2.

v) Aspect Ratio for wing = 3.

vi)  $t/c_{\max}$  for wing = 0.30

vii) Taper Ratio = 0.

viii)  $\Lambda_{\text{wing}} = 60^\circ$

ix)  $C_{vt} = 0.07$

x)  $L_{vt} = 35$  ft

xi)  $\Lambda_{vt} = 63^\circ$

xii)  $C_{ht} = 0.11$

xiii)  $L_{ht} = 50$  ft

xiv)  $\Lambda_{ht} = 63^\circ$

xv)  $t/c_{\max}$  for vertical tail and horizontal tail = 0.50

Atmospheric properties at 30000 ft.: Temperature = 228.79 K; pressure = 30149 N/(m<sup>2</sup>) ; Density = 0.45904 kg/(m<sup>3</sup>); viscosity =  $1.4876 \times 10^{-5}$  kg/(m-s); Speed of sound = 303.2301 m/s.

20

End Semester Examination, Dec. 2016  
B. Tech.–Sixth Semester  
VIBRATIONS AND AEROELASTICITY (AE-801)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

- Q.1
- Define free vibrations.
  - How are  $\zeta$ ,  $S$  and  $f$  related to each other?
  - A vibratory system has amplitude of  $10X_0$ , where  $X_0$  is reference amplitude. Express above quantity in decibel (dB).
  - Write dynamic equation of spring mass system and characteristic equation. Find  $\tilde{S}_n$ .
  - What is Rayleigh's Energy Method?
  - Find the transverse natural frequency of cantilever beam.
  - Give two real life example of critical damping.
  - What are generalized coordinates?
  - What is flutter?
  - Write approximate location of A.C., C.G., flexural centre (E.I) on an aerofoil.

2x10

PART-A

- Q.2
- A 4.53 kg mass is attached to lower end of a spring whose upper end is fixed and vibrates with natural period of 0.45 sec. Determine natural time period when 2.26 kg mass is attached to the mid-point of the same spring with the upper and lower ends of spring being fixed. 10
  - Give one example each of 1-DoF, 2-DoF, 3-DoF, clearly showing coordinates. 6
  - Find equivalent spring constant of spring in series. 4
- Q.3
- Derive the response equation for under-damped system with spring-mass-damper. Show vector addition of all these forces. Draw the response curve. 15
  - The gun barrel and the recoil mechanism have a mass of 500 kg with a recoil spring of stiffness 10,000 N/m. Find the critical damping coefficient of the damped system. 5
- Q.4
- Derive differential equation for 2-DoF system for forced vibrations starting with free body diagram. 10
  - Find the natural frequencies and mode shapes of a spring-mass system for 2-DoF system which is constrained to move in the vertical direction only. Take  $m_1 = m_2 = m$  and  $k_1 = k_2 = k_3 = k$ . 10

PART-B

- Q.5
- What are different aeroelastic phenomenon. Classify them. 5
  - Find expression for divergence speed  $V_d$  for two-dimensional case. Discuss how  $V_d$  can be increased. 15
- Q.6
- What is flutter? What are different types of flutter phenomena? 10
  - Write response of a damped system under harmonic force. Explain with help of a graph and applications of such a system. 10
- Q.7
- What is buffeting? How is flutter speed determined experimentally? 10
  - Find the  $X$  and  $\Phi$  of a single-degree-of-freedom system with  $m = 10 \text{ kg}$ ,  $c = 20 \text{ N-s/m}$ ,  $k = 4000 \text{ N/m}$  under an external force  $F(t) = 100 \text{ N} \cos 10t$ . 10

End Semester Examination, Dec. 2016  
B. Tech.(Aero) — Seventh Semester  
BOUNDARY LAYER THEORY (AE-802)

Time: 3 hrs.

Max Marks: 100

No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

Q.1 Answer the following:

- a) Explain shape factor with relevant significance.
- b) What is the difference between exact solution and approximate method?
- c) Give an expression for Pohlhausen dimensionless quantity ( $\Lambda$ ) and define it with its physical interpretation for two dimensional flows.
- d) Explain the physical significance with formulae of:
  - i) Prandtl Number.
  - ii) Eckert number.
- e) Define forced and free flow on the basis of dimensionless numbers.
- f) Explain briefly the effect of transition over shape factor.
- g) Write a short note on asymptotic suction profile.
- h) Explain the method of cooling of gas to control the boundary layer.
- i) Define laminar sub-layer.
- j) What are Reynold's stresses and explain their importance?

$2 \times 10$

PART-A

Q.2 A small bug rests on the outside of a car side window as shown in the figure below. The surrounding air has a density of  $1.2 \text{ kg/m}^3$  and kinematic viscosity of  $1.5 \times 10^{-5} \text{ m}^2 / \text{s}$ . To first order, we can approximate the flow as flat plate flow with no pressure gradient and the start of the boundary layer begins at the leading edge of the window.



- a) Determine the minimum speed <sup>100</sup> at which the bug will be sheared off of the car window if the bug can resist a shear stress of up to  $1 \text{ N/m}^2$ .
- b) What is the total skin friction drag acting on the window at a speed of  $U=20 \text{ m/s}$ ?
- c) Ignoring the presence of the bug, at what stream wise location will the boundary layer separation point occur on the window? Justify your answer.

Explain all the assumptions and boundary conditions with the help of diagrams and nomenclatures.

20

Q.3 Obtain a method for approximate solution for the flow past a flat plate at zero incidence using the momentum equation where the flow is incompressible, laminar flow. Compare the solution error with the exact solution obtained from Blasius solution in terms of shear stress, drag, and shape factor when the velocity profile is given as a function:

$$f(y) = 2y - 2y^3 + y^4$$

Explain all the assumptions and boundary conditions with the help of diagrams and Nomenclatures.

20

- Q.4 a) Simplify the Navier-Stokes equation using thermal boundary layer simplification.  
 b) Derive the basic energy equation using the first law of thermodynamics.  
 c) Explain how and under what condition, Eckert number behaves like Mach number.  
 d) Explain theoretically the effect of Prandtl number over the two boundary layers i.e. Velocity boundary layer and thermal boundary layer. Explain the general properties of thermal boundary layer over the adiabatic wall. Explain all the assumptions and boundary conditions with the help of diagrams and nomenclatures. 5 × 4

### PART-B

- Q.5 a) Derive the Navier-Stoke equations for the method of small disturbances for the three dimensional flow with three dimensional disturbances; i.e.  $U; V; W \neq 0$ . 6  
 b) Derive and explain why Orr-Somerfield equation is valid for two dimensional flows. Explain all the assumptions and boundary conditions with the help of diagrams and nomenclatures. 4  
 c) Derive and explain the possible methods to obtain a solution for the stability of the flow as obtained in Orr-Somerfield equation for three-dimensional flow. 5  
 d) Explain the limit of stability by Eigen values and general properties of Orr- Somerfield equation? 5  
 Note: Explain all the assumptions and boundary conditions with the help of diagrams and nomenclatures.
- Q.6 a) Explain the following methods of boundary layer control:  
 i) Motion of the solid wall.  
 ii) Cooling of the wall. 5  
 b) Derive the fundamental equations of boundary layer suction with the help of a diagram and obtain a theoretical result using the exact solution method over the flat plate with exponential distribution of suction on porous plate with incompressible flow. Compare it with exact solution obtained by continuous distribution of suction on porous plate. Explain all the assumptions and boundary conditions with the help of diagrams and nomenclatures. 15
- Q.7 a) Explain the mean motion and fluctuations for turbulent flow. Explain the concept of laminar sub-layer. 5  
 b) Derive the expressions and explain the concept of Reynold's stresses for the compressible flow with the help of compressible Navier-Stoke equation. Explain all the assumptions and boundary conditions with the help of diagrams and nomenclatures. 10

End Semester Examination, Dec. 2016  
B. Tech.(Aeronautical) — Seventh Semester  
ROCKET PROPULSION (AE-821)

Time: 3 hrs.

Max Marks: 100

No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

Q.1 Answer the following questions:

- a) State the difference between rocket propulsion and jet propulsion.
- b) State the difference between effective exhaust velocity and characteristics velocity.
- c) What is nuclear propulsion?
- d) What do you mean by erosive burning?
- e) Write the significance of nozzle thermal protection.
- f) What do mean by monopropellant and bi-propellant in liquid rocket propulsion?
- g) What are the factors which restrict the hybrid propellant combustion?
- h) What are the basic problems with cryogenic storage problems?
- i) How could we provide the huge quantity of energy required in electric propulsion?
- j) Why do we neutralize the charged exhaust in electric propulsion system?  $2 \times 10$

PART-A

- Q.2 a) Write down any five characteristics of an ideal rocket. 5  
b) Explain the under-expanded and over-expanded nozzle for different back pressures. 10  
c) Write a note on thrust vector control and its application for a single nozzle 5
- Q.3 a) The following measurements were made on a rocket at sea level condition:

Burn duration	40 sec.
Initial mass before test	1210 kg
Mass of rocket motor after test	215 kg
Average thrust	62.250 N
Chamber pressure	7.00 MPa
Nozzle exit pressure	0.070 MPa
Nozzle throat diameter	0.0855 m
Nozzle exit diameter	0.2703 m

Determine  $\dot{m}$ ,  $v_2$ ,  $c^*$ ,  $c$  and  $I_s$  at sea level, and  $c$  and  $I_s$  at 1000 m and 25,000 m altitude. Assume an invariant thrust and mass flow rate and negligible short start and stop transients. 10

- b) Describe the different types of igniters generally used for solid rocket motors. 5  
c) Name the different types of grain configuration along with their characteristics. 5
- Q.4 a) Name the different types of solid propellants normally used in rocket propulsion along with their desirable properties. 10  
b) Write the differences between solid rocket motor and liquid rocket engine. 10

PART-B

- Q.5 a) With the help of schematic diagram explain the turbo-pump feed system. What are the cycles on which turbo-pump feed system work? Explain any one briefly. 10  
b) With the help of schematic diagram explain the gas pressure feed system. 5  
c) List down any five physical hazards related to liquid propellants. 5

- Q.6 a) Explain the injection system of a liquid rocket engine. What do you mean by the steady state heat transfer cooling? Explain any one steady cooling technique in brief. 10
- b) Explain the mechanism of propellant ionization in an Ion propulsion system. Explain briefly the different types of electric propulsion systems. 10
- Q.7 a) State some of the necessary steps to be followed while loading the cryogenic propellant in the fuel tanks. 5
- b) With the help of schematic diagram explain the essential parts of hybrid rocket motor. 5
- c) Briefly explain the electrostatic devices for electric propulsion and principle and working of electromagnetic thrusters. 10

# End Semester Examination, Dec. 2016

B. Tech.—Seventh Semester

## FLIGHT DYNAMICS (AE-824A)

Time: 3 hrs.

Max Marks: 100

No. of pages: 2

Note: Attempt **FIVE** questions in all; **Q.1** is **compulsory**. Attempt **ANYTWO** questions from **PART-A** and **TWO** questions from **PART-B**. Each question carries equal marks.

Instructions:

- Use ambient density at sea-level as  $1.225 \text{ Kg/m}^3$  and the acceleration due to gravity at the Earth surface as  $9.81 \text{ m/s}^2$ .
- Ensure that your calculations are having 4 decimal points precision.
- You may assume data wherever required however, you are not allowed to substitute the data values which are needed to be obtained by certain expected calculations.
- Use of calculator is permitted, however, sharing of calculator is not permitted.

Q.1 Answer the following questions (**ANY TEN**):

- Explain the term stick-free neutral point.
- For a given value of  $C_L$  the elevator deflection required in pull-up is more than that in a steady level flight. Explain.
- Distinguish between 'sideslip and yaw'.
- What is the purpose of dorsal fin?
- What is adverse yaw?
- What is the function of trim tab?
- Define the 'ground axes system'.
- Describe spiral divergence.
- What is meant by Dutch Roll?
- What is automatic control? How it helps in altering the stability of an airplane?
- What is the criterion for the stability of a linear system? Explain by giving example of a second-order system

2×10

### PART-A

Q.2 Define the term 'maneuver point stick-fixed' and 'maneuver point stick-free'. Explain why for a given value of  $C_L$  the elevator deflection required in pull-up is more than that in a steady level flight. 20

Q.3 An airplane has the following characteristics:

$$C_{L_{\alpha}} = 0.085 \text{ deg}^{-1}, C_{L_{\alpha\dot{\alpha}}} = 0.058 \text{ deg}^{-1}, (dC_L / d\alpha_e) = 0.032, C_{h_{\alpha\dot{\alpha}}} = -0.003 \text{ deg}^{-1}, C_{h_{\alpha\ddot{\alpha}}} = -0.0055,$$

$$i_w = 0, r_{0L} = -20, i_t = -10, v = 0.5r, S_t = 0.25 S, l_t = 3c, (w/s) = 1500 \text{ N/m}^2,$$

$$\text{Location of aerodynamic center} = 0.25c, y = 1.0, (C_{m\alpha})_{f,n,p} = 0.37 \text{ rad}^{-1}.$$

Obtain stick-fixed neutral point and stick-free neutral point when  $C_{h_{\alpha\dot{\alpha}}}$  is changed to 0.003.

20

Q.4 a) A model of an airplane is tested in a wind tunnel without the vertical tail. Contributions of various components give  $C_{ys} = -0.0012 \text{ deg}^{-1}$ . If the vertical tail is to be positioned at a point on the aft end of the fuselage giving a tail length of 4.8 m, how much vertical tail area is required to give an overall  $C_{ys} = -0.0012 \text{ deg}^{-1}$ ? Assume that the vertical tail would have an effective aspect ratio of 2, the wing area is  $18 \text{ m}^2$ , wing span is 10.6 m and the wing is set at the middle of the fuselage. 10

b) Obtain the minimum control speed in the event of an engine failure for the following airplane:

$$S = 65 \text{ m}^2, S_v = 6.5 \text{ m}^2, l_v = 10.5 \text{ m}, \text{BHP} = 880 \text{ kW (per-engine)}, \text{propeller efficiency} = 75\%,$$

$$y_p = 4.2 \text{ m}, dC_{L_v} / d\alpha_r = 0.02 \text{ deg}^{-1}, (\alpha_r)_{\max} = 25^\circ.$$

Explain the dihedral effect in detail and enlist the various factors causing it.

**10**

**PART-B**

- Q.5 a) The approximate form of Dutch roll mode can be described in the state-space form as:

$$\begin{bmatrix} \Delta \dot{s} \\ \Delta \dot{r} \end{bmatrix} = \begin{bmatrix} Y_s/u_0 & \frac{Y_r}{u_0} + 1 \\ N_s & N_r \end{bmatrix} \begin{bmatrix} \Delta s \\ \Delta r \end{bmatrix} + \begin{bmatrix} Y_{ur}/u_0 \\ Nu_r \end{bmatrix} \Delta u_r$$

It is given that:

$$Y_s = -2.6ms^{-2}, N_r = -0.34s^{-1}, Y_{ur} = -1.572ms^{-2}, Y_r = 0.741ms^{-1}, u_0 = 51.33ms^{-1}, \\ N_{ur} = 0.616s^{-2}, \text{ and } N_s = 0.64s^{-2}$$

- i) Examine the stability of the motion.  
ii) Obtain the period of oscillatory mode and the time to damp to half amplitude.

**10**

- b) Consider the control system given by the following state-space equation:

$$\dot{x} = Ax + Bu \text{ and } y = Cx + D \text{ where,}$$

$$A = \begin{bmatrix} 1.05 & 3.10 & 1.00 \\ 4.00 & -3.20 & 0.75 \\ -2.50 & 0.00 & 1.00 \end{bmatrix}, B = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}, C = [1 \quad 1 \quad 1], D = 0$$

$x$  is the state-vector and  $u$  is the control input.

- i) Check if the system is controllable and observable.  
ii) Comment on the stability of the system by giving proper justification.  
iii) Design a full-state feedback controller for the above system so that, the final closed loop system has poles at  $s = -1$ ,  $s = -0.5$  and  $s = -5$ .

**10**

- Q.6 a) Explain the significance of Routh's discriminant in determining the stability of the aircraft with the help of an example. **10**  
b) Drive an expression for the tail contribution to the pitching moment of an aircraft. **10**

- Q.7 a) Write a short note on phugoid.  
b) What is the adverse yaw condition? Explain it in terms of the stability of an aircraft.  
c) Write a short note on the directional control of a fixed-wing aircraft and the factors affecting it.  
d) Explain one solution technique for determining the states of a linear time invariant system with example. **5×4**



End Semester Examination, Dec. 2016  
B. Tech.— Seventh Semester  
INTRODUCTION TO WIND ENERGY (AE-825)

Time: 3 hrs.

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

- Q.1
- a) Draw a sketch of screen wind machine.
  - b) What is Ferrel cell?
  - c) Derive the expression for power contained in wind.
  - d) State Betz limit.
  - e) Draw  $C_p$  Vs Tip speed ratio for different WECS.
  - f) What is extraneous loading?
  - g) What do you mean by direct heat application?
  - h) What are different types of wind turbine noises?
  - i) What is capacity factor?
  - j) Draw a plot of capital cost vs rated output capacity for installed system and wind machines only.
- 2 × 10

PART-A

- Q.2
- a) List advantages of VAWTs. 10
  - b) What is tip speed ratio? What are the factors on which optimum tip speed ratio depend? 10
- Q.3
- a) Draw VAWT rotor blades wind forces and velocities diagram at different positions. 7½
  - b) Why are wind turbines provided with variable pitch? 7½
  - c) Why are rotor blades twisted? 5
- Q.4
- a) Maximum power extracted by any WECS from wind has certain limit. What is it called? Derive an expression for maximum extractable power. 10
  - b) Draw and explain power in wind stream vs wind speed curve for different diameters of wind turbine. 10

PART-B

- Q.5
- a) Explain use of wind energy for pumping application. 10
  - b) Explain the factors that affect site selection. 10
- Q.6
- Explain environmental impact of wind machines. 20
- Q.7
- a) How do power requirements affect system design objectives? 5
  - b) What are the advantages of large centralized wind energy system? 7
  - c) What are different evaluation criteria for economic and social viability of WECS? 8

End Semester Examination, Dec. 2016  
B. Tech.— Seventh Semester  
PRINCIPLES OF HELICOPTER ENGINEERING (AE-826)

Time: 3 hrs.

Max Marks: 100

No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

- Q.1 a) Briefly explain the basic parts of the helicopter.  
b) How lift is generated by the rotor blades?  
c) Explain the vortex ring state.  
d) Explain the concept of autorotation.  
e) Write the differences between piston engine and gas turbine engine. 4 × 5

PART-A

- Q.2 a) With the help of a hinge arrangement, show the flapping, lagging and feathering motion and briefly explain the importance of each motion.  
b) How the power is transferred from the engine to the rotors? Explain in detail. 10 × 2
- Q3 a) In actuator-disc analysis why do we assume that the rotor has infinite number of blades?  
b) Explain the ground effect on the lifting rotor with the help of relevant diagrams? What is the advantage of this effect? 10 × 2

- Q4 a) Derive the characteristic equation for longitudinal dynamic stability using all the assumptions. Given:

$$\frac{du}{dt} - x_u u - x_w w - x_q \frac{d\eta}{dt} + w_{o''} \cos \hat{\tau}_o = x_{B1} B_1 + x_{s, o'' o}$$

$$-z_u u + \frac{dw}{dt} - z_w w - (\hat{V} + z_q) \frac{d\eta}{dt} + w_{c''} \sin \hat{\tau}_c = z_{B1} B_1 + z_{s, o'' o}$$

$$-m_u u - m_w w - m_w \frac{dw}{dt} + \frac{d^2 \eta}{dt^2} - m_q \frac{d\eta}{dt} = m_{B1} B_1 + m_{s, o'' o}$$

- b) The longitudinal derivatives for the hovering case (c.g. on shaft axis) are:

$$x_u = -0.032, x_w = 0, x_q = 0$$

$$z_u = 0, z_w = -0.52, z_q = 0$$

$$m_u^t = 0.016, m_w^t = 0, m_q^t = -0.099$$

$$\text{Given: } \tau^* = 47.6, \hat{\tau} = 1.82 \text{ seconds, } w_o = 0.0856 \text{ and } i_B = 0.11$$

$$m_u = 6.8, m_w = 0, m_q = -0.90$$

Calculate the time to halve amplitude and time to double amplitude. Also comment on the stability characteristics. 10 × 2

PART-B

- Q.5 a) Explain in detail the auto-stabilization.  
b) What is the purpose of using a gyro device in helicopter? 10 × 2
- Q.6 What are the methods used for vibration reduction? Explain in detail the fixed frequency "flexi-spring" absorber and centrifugal pendulum type observer. 20

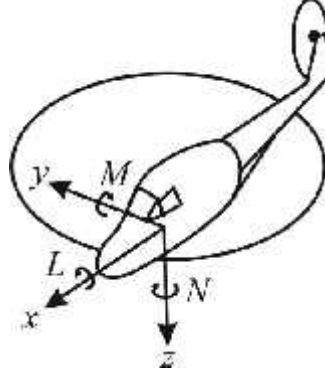
- Q.7 a) The exciting forces i.e. hub forces and moments from each blade can be resolved into force components X,Y,Z and moment components L,M,N relative to fixed axes in the helicopter. With the help of the information provided, show that:

$$X = -\frac{1}{2}b \sum_{m=1}^{\infty} [P_{mb-1} + T_{mb-1} + P_{mb+1} - T_{mb+1}] \cos mb\{\$$

$$-\frac{1}{2}b \sum_{m=1}^{\infty} [Q_{mb-1} - S_{mb-1} + Q_{mb+1} + S_{mb+1}] \sin mb\{$$

Given: azimuth angle of  $k^{th}$  blade,  $\{\_k = \{\_ + 2\pi k / b$

$$X_k = -R_{1k} \cos \{\_k + R_{2k} \sin \{\_k .$$



- b) Why elimination or reduction of vibration is important?

10×2

End Semester Examination, Dec. 2016  
B. Tech.–Seventh / Eighth Semester  
BASICS OF COMPUTATIONAL FLUID DYNAMICS(AE-827)

Time: 3 hrs

Max Marks: 100

No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

- Q.1
- a) GIVE THE RELATIONS BETWEEN SURFACE INTEGRAL, VOLUME INTEGRAL AND LINE INTEGRAL FOR A CONTROL SURFACE AROUND A CONTROL VOLUME.
  - b) WHAT IS TIME MARCHING AND SPACE MARCHING? CAN A GOVERNING EQUATION BE BOTH SPACE AND TIME MARCHING? GIVE AN EXAMPLE FOR THE SAME.
  - c) WHAT IS CONSERVATION AND NON-CONSERVATION FORMS OF EQUATIONS?
  - d) DEFINE 'EXPLICIT' AND 'IMPLICIT SCHEMES'. GIVE ITS ADVANTAGES AND DISADVANTAGES.
  - e) WHAT ARE VECTOR PROCESSORS AND SERIAL PROCESSORS?
  - f) DEFINE 'COMPUTATIONAL PLANE' AND 'PHYSICAL PLANE'.
  - g) WHAT IS PISO MODEL? TO WHICH TYPE OF FLOWS CAN IT BE APPLIED AND WHY?
  - h) LIST OUT DIFFERENT RANS TECHNIQUES FOR FLOW COMPUTATION.
  - i) DEFINE: FDM, FEM AND FVM.
  - j) GIVE THE RELATIONS FOR:
    - i) LENGTH SCALE RATIO.
    - ii) TIME SCALE RATIO.
    - iii) VELOCITY SCALE RATIO.

2x10

PART-A

- Q.2
- a) DERIVE THE 3D NSE FOR VISCOUS FLOW.
  - b) DERIVE THE 3D ENERGY EQUATION FOR VISCOUS FLOW.
  - c) WRITE A NOTE ON THE GOVERNING EQUATION OF CFD FOR A 3D STEADY STATE FLOW.

8

7

5

- Q.3
- a) WRITE SHORT NOTES ON THE FOLLOWING FOR STEADY AND UNSTEADY FLOWS:
    - i) HYPERBOLIC EQUATIONS.
    - ii) Parabolic equations.
    - iii) Elliptic equations.
  - c) Give the error analysis and calculate the CFL for 1D heat conduction equation.

10

10

- Q.4
- a) Derive the transformation from physical to computational plane and back using metrics and jacobians only. Derive the transformed governing equation of CFD. 10
  - b) Give the transformed 2D continuity equation for the following stretched grid:

$$x = \xi$$

$$y = e^{\eta} - 1$$

10

PART-B

- Q.5
- a) Write a note on 'pressure correction method' and list out the steps for SIMPLE algorithm.
  - b) Write a note on 'MacCormack scheme'.
- Q.6
- a) Describe the methodology for 1D and 2D diffusion.
  - b) Draw the flow charts for:
    - i) SIMPLE Algorithm.
    - ii) PISO Algorithm.
    - iii) SIMPLEC Algorithm.
- Q.7
- a) Define:
    - i) Discretization error.
    - ii) Round-off error.
  - b) Using the 1D heat equation, derive the stability criteria for solving it using CFD.

10

10

8

12

4

6

c) Give the stability criteria for 1D wave equation. How will you input this in Fluent?

4

d) Write the finite difference scheme for following equations for following conditions:

$$\frac{\partial T}{\partial t} = r \frac{\partial T}{\partial x} \rightarrow \text{Accuracy of solution must be } 2^{\text{nd}} \text{ order.}$$

6

End Semester Examination, Dec. 2016  
B.Tech. -Third / Fourth Semester  
BASICS OF AUTOMOBILE ENGINEERING (AU-405)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Answer in brief:

- a) What are the salient features of a Hatch back car?
- b) What is the function of differential?
- c) What is D.T.S.S.I system?
- d) What is the function of a cut out relay?
- e) Explain the basic principle of working of a shock absorber.
- f) What is leading shoe?
- g) What is the function of camshafts in the tyre?
- h) When does the necessity of bleeding the brakes arise?
- i) A tyre is designated as 14.5- SR-13. What do the different symbols signify?
- j) What is the function of distributor? 2x10

PART-A

- Q.2 a) Explain advantages of front wheel drive over rear wheel drive with the help of a neat sketch. 10
- b) Write short notes on:
- i) Clutch. 3
  - ii) Differential. 4
  - iii) Propeller shaft. 3
- Q.3 a) With the help of neat sketch explain the fuel supply system used in petrol vehicle. 10
- b) Write short notes on:
- i) Ignition system.
  - ii) Cooling system. 10
- Q.4 a) What is the necessity of a transmission in a vehicle? Explain with the help of total resistance tractive effort curve. 10
- b) With the help of a neat sketch explain construction and working of single plate helical coil spring clutch. 10

PART-B

- Q.5 a) What is the function of steering gears? Explain the working of a rack and pinion type of steering gear. 10
- b) Explain the characteristics of leaf and coil spring each in detail. 10
- Q.6 a) Explain the construction and working of hydraulic braking system of Maruti Alto Car. 10
- b) Write short notes on:
- i) A.B.S. (Antilock braking system).
  - ii) Characteristics of brake fluid. 5x2
- Q.7 a) Draw a neat sketch of tyre section and then explain the importance of its each component. 10
- b) Write short notes on:
- i) Wheel balancing. 3

ii) Tubeless tyres.	3
iii) Merits and demerits of light alloy wheels	4

# End Semester Examination, Dec. 2016

B. Tech. – Fourth Semester

## FUELS AND LUBRICANTS (AU-406A)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Answer briefly:

- a) What are homogeneous and heterogeneous mixtures?
- b) What is hydrogenation?
- c) What do you mean by cracking?
- d) What is viscosity index?
- e) What are the different factors affecting delay period?
- f) Briefly explain advantages of hydrogen as fuel.
- g) Write advantages of an electric vehicle.
- h) What is boundary lubrication?
- i) What are semisolid lubricants?
- j) What are greases and lubricants?

2x10

### PART-A

- Q.2 a) Explain refining process of petroleum with the help of a neat sketch. 12  
b) Explain four important qualities of S.I. engine fuel. 8

Q.3 Explain the following terms:

- a) Neutralization number.
- b) Saponification number.
- c) Volatility.
- d) Aniline point.

5x4

- Q.4 a) Explain the different stages of combustion in S.I. engines with the help of a neat sketch. 10  
b) What is knock limited indicated mean effective pressure? 10

### PART-B

- Q.5 a) Explain the working of alcohol surface ignition engine with the help of a neat sketch. 15  
b) Write a short note on: 'fuel cell'. 5

- Q.6 a) Explain how lubricants are classified. 10  
b) What are the specific requirements for automotive lubricants? 10

Q.7 Explain in detail:

- a) Extreme pressure lubrication.
- b) Hydrodynamic lubrication.

10x2



End Semester Examination, Dec. 2016  
B. Tech.–FifthSemester  
AUTO ELECTRICALS AND ELECTRONICS(AU-503)

Time: 3 hrs.

Max Marks:100

No. of pages:1

Note: Attempt FIVE questions in all;Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

- Q.1    a) Explain "Earthed" and "Insulated" return system.  
      b) Define battery rating and battery efficiency.  
      c) Describe various torque terms associated with starting motor.  
      d) Discuss the importance of modern "In-Vehicle Infotainment" system.  
      e) Write a short note on: 'spark play fouling' and 'head light dazzling'. 4×5

PART-A

- Q.2    a) Give a layout of the lighting and accessory systems of an automobile. 10  
      b) Explain with the help of a neat sketch construction and functions of an ignition coil. 10
- Q.3    a) What are the defects occur in batteries? Write causes for such defects with suitable remedies. 10  
      b) Explain different types of battery tests. 10
- Q.4    a) What are the defects occur in cranking motor? Write causes for such defects with suitable remedies. 12  
      b) What is the function of alternator? Discuss its advantages over DC generator. 8

PART-B

- Q.5    a) Write different types of sensors used in an automobile. Explain air mass flow sensor in detail. 10  
      b) Discuss the various effects of suppression on the performance of an automobile engine. 10
- Q.6    a) Discuss with the help of a neat sketch the ignition system of 4 cylinder spark ignition engine. 10  
      b) What are characteristics of the ideal spark plug? 10
- Q.7    a) What is the purpose of the indicating and warning devices provided in vehicle? Enlist reasons. 10  
      b) Explain the various antidazzle devices used on automobile of today. Compare them with the earlier types. 10

End Semester Examination, Dec. 2016  
B. Tech.–Fifth Semester  
AUTOMOTIVE COMPONENTS DESIGN (AU-506)

Time: 3 hrs.

Max Marks: 100

No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Briefly answer:

- a) Write the expression for the effect of size factor under bending load.
- b) Explain stress concentration phenomenon.
- c) What is surging in spring?
- d) What are the different types of bearings? Describe shortly each in brief.
- e) What is the usefulness of gears over the belt and chain drives?
- f) Write the Lewis equation.
- g) State the function of piston rings.
- h) What are the different forces acting on connecting rod?
- i) Why cylinder liners are used?
- j) What are the desired properties a good lubricant?

2 × 10

PART-A

- Q.2 a) A bar of circular cross-section is subjected to alternating tensile forces varying from a minimum of 200 kN to a maximum of 500 kN. It is to be manufactured of a material with an ultimate tensile strength of 900 MPa and an endurance limit of 700 MPa. Determine the diameter of bar using safety factors of 3.5 related to ultimate tensile strength and 4 related to endurance limit and a stress concentration factor of 1.65 for fatigue load. Use Goodman straight line as basis for design. 10
- b) Derive the expression for Soderberg criterion for combination of stresses under reversed bending loading for brittle materials. 10

- Q.3 a) How a hollow shaft has greater strength and stiffness than solid shaft of equal weight? 5
- b) A shaft supported at the ends in ball bearings carries a straight tooth spur gear at its mid span and is to transmit 7.5 kW at 300 r.p.m. The pitch circle diameter of the gear is 150 mm. The distances between the centre line of bearings and gear are 100 mm each. If the shaft is made of steel and the allowable shear stress is 45 MPa, determine the diameter of the shaft. The pressure angle of the gear may be taken as 20°. 15

- Q.4 Design a journal bearing for a centrifugal pump from the following data:  
Load on the journal = 20000 N; speed of the journal = 900 r.p.m; type of oil is SAE 10, for which the absolute viscosity at 55° C = 0.017 kg/ms ambient temperature of oil = 15.5° C, maximum bearing pressure for the pump = 1.5 N/mm<sup>2</sup>. Also, calculate the mass of the lubricating oil required for artificial cooling, if rise of temperature of oil be limited to 10° C. Heat dissipation coefficient = 232 W/m<sup>2</sup>/°C. 20

PART-B

- Q.5 A pair of helical gears are to transmit 15 kW. The teeth are 20° stub in diametral plane and have a helix angle of 45°. The pinion runs at 10000 r.p.m. and has 80 mm pitch

diameter. The gear has 320 mm pitch diameter. If the gears are made of cast steel having allowable static strength of 100 MPa; determine a suitable module and face width from static strength considerations and check the gears for wear, given  $\sigma_{es} = 618 \text{ MPa}$ . 20

- Q.6 Design the piston head, piston rings, radial ribs and piston barrel for a cast iron piston for a single acting four stroke engine for the following data:  
 cylinder bore=100 mm; stroke=125 mm; Max.gas pressure=5 N/mm<sup>2</sup>; Mechanical efficiency=80%; Fuel consumption = 0.15 kg per brake power per hour, HCV of fuel=42 × 10<sup>3</sup> kJ/kg; Speed=2000 rpm. Any other data required for the design may be assumed. 20
- Q.7
- What are the various forces acting on connecting rod? 3
  - How the fluctuation of energy in an I C engine is being controlled by a flywheel? 2
  - Explain the turning moment diagram for a four stroke I C engine. 3
  - Design the I- section shank of the connecting rod of an I.C. engine running at 1800 r.p.m. and developing a maximum pressure of 3.15 N/mm<sup>2</sup>. The diameter of the piston is 100 mm; mass of the reciprocating parts per cylinder 2.25 kg; length of connecting rod 380 mm; stroke of piston 190 mm and compression ratio 6:1. Take a factor of safety of 6 for the design. The density of material of the rod may be taken as 8000 kg/m<sup>3</sup>. The constant for numerator be taken as 320 N/mm<sup>2</sup> and the denominator constant 1/7500. 12

End Semester Examination, Dec. 2016  
B. Tech.–Six/SeventhSemester  
VEHICLE MAINTENANCE (AU-603)

Time: 3 hrs.

Max Marks:100

No. of pages:1

Note: Attempt FIVE questions in all;Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Short answer type questions:

- a) Why is vehicle maintenance important?
- b) Name the different types of service stations.
- c) What are the different types of screwdrivers?
- d) What do you mean by brake bleeding?
- e) What is cylinder boring?
- f) What is the function of a fuel pump and fuel filter?
- g) Define clutch grabbing.
- h) What is the function of a gearbox?
- i) Define Toe-in and Toe-out.
- j) What do you mean by retreading of tyres?

2×10

PART-A

- Q.2 a) Name the different types of maintenance. Explain each of them in detail. 10
- b) Explain important criteria for a service station layout planning. 10
- Q.3 a) What is a injector testing and cleaning machine? Explain the procedure of injector testing and cleaning in brief. 10
- b) Why wheel balancing is necessary? How a wheel is dynamically balanced on wheel balancing machine? 10
- Q.4 a) Name the methods used for cleaning an engine? Explain them in detail. 10
- b) Explain engine disassembly procedure in detail. 10

PART-B

- Q.5 a) Describe various components of a petrol injection system. Explain with a neat diagram. 10
- b) Write down various symptoms and possible faults in a diesel injection system. 10
- Q.6 a) What is a differential? Why it is needed? Explain its construction and working with diagrams? 10
- b) Explain the working principle of clutch with the help of a neat diagram. 10
- Q.7 a) Explain the procedure for wheel and tyre maintenance in detail. 10
- b) Explain procedure for service of master cylinder of a vehicle in detail. 10

End Semester Examination, Dec. 2016  
B. Tech.–Sixth Semester  
AUTOMOTIVE POLLUTION AND ITS CONTROL(AU-610)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

- Q.1
- a) What do you mean by global warming?
  - b) What are operating variables?
  - c) Define dehydrogenation, polymerization and agglomeration Peaches.
  - d) What is  $NO_x$ ? Enlist other harmful gases present in exhaust gas?
  - e) Enlist types of hydrocarbon emission.
  - f) Define compression ratio, displacement (piston) crevice zone and combustion chamber configuration.
  - g) What is noise pollution?
  - h) How  $A/F$  ratio effect on  $NO_x$  emission?
  - i) What do you mean by greenhouse effects?
  - j) Define FID (Flame ionization detector) and NDIR (Non dispersive infrared analyzer).
- 2x10

PART-A

- Q.2
- a) What is environment pollution and environmental pollutant? 10
  - b) How pollution affects atmosphere? Explain. 10
- Q.3
- a) Discuss engine design and operating variables affecting pollution. 10
  - b) Discuss  $NO_x$  formation in S.I engine. 10
- Q.4
- a) Discuss polynuclear and polycyclic H.C. 10
  - b) Explain cyclic or ring compounds and its types. 10

PART-B

- Q.5
- What is smoke? Discuss different types of smoke and factors affecting smoke formation. 20
- Q.6
- What causes  $NO_x$  formation in S.I. engine? Explain the effects of following on  $NO_x$  emission:
- i)  $A/F$  ratio.
  - ii) Spark advance.
  - iii) Combustion chamber configuration. 20
- Q.7
- a) Write a short note on smoke meter. 10
  - b) Write a short note on flame ionization detector. 10

End Semester Examination, Dec. 2016  
B. Tech.– Fifth / Sixth Semester  
AUTOMOTIVE POLLUTION AND ITS CONTROL(AU-610)

Time: 3 hrs.

Max Marks:100

No. of pages:1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Short answer type questions:

- a) What is smog?
- b) Why CO is produce in S.I engines?
- c) Explain the term 'global warming'.
- d) What are the different types of hydro carbon emissions?
- e) What is the function of a catalytic converter?
- f) What is the function of E.G.R?
- g) What do you mean by FID (Flame ionization detector)?
- h) For what purpose SMED test performed?
- i) Discuss two hazards pollutants have on vegetation.
- j) What do you mean by dilution tunnels?

2×10

PART-A

Q.2 What are the different sources of air pollution from automobiles? Explain how these can be reduced and what are the effects of these pollutions on human beings. 20

Q.3 Explain how design and operating variables affect exhaust emissions. Explain two such variables in detail. 20

Q.4 a) Discuss in detail:  
i) Poly nuclear H.C  
ii) Poly cyclic H.C 5×2  
b) Explain cyclic or ring compounds and its type. 10

PART-B

Q.5 a) Explain the causes of smoke and particulate emissions in C.I engines in detail. 10  
b) Write short notes on:  
i) Noise pollution from automobiles.  
ii) Emission standards. 5×2

Q.6 With help of neat sketches, explain the working of:  
a) E.G.R (Exhaust gas recirculation system) 7  
b) Catalytic converter. 7  
c) Fuel cell. 6

Q.7 a) Explain NDIR method of measuring carbon monoxide. 10  
b) Differentiate between US Fedral and ECE (United Nations Economic Commission for Europe) test procedures for emission. 10

End Semester Examination, Dec. 2016  
B. Tech.–SeventhSemester  
MEASURING TECHNIQUES (AU-626)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

- Q.1 Explain following terms in brief:
- a) Threshold and resolution.
  - b) Primary and secondary transducer.
  - c) Absorption and transmission dynamometers.
  - d) Absolute pressure and gauge pressure.
  - e) Function of 'growler'.

4x5

PART-A

- Q.2 A first order system, when subjected to a step input has a temperature rise of 25° C after one hour and 37.5 °C after two hours from cold conditions. Calculate its final steady state temperature rise and the thermal time constant. 20
- Q.3 Give an overview of five mechanical devices used as primary detectors and derive their output in terms of their physical dimensions. 20
- Q.4 Describe working of dynamometers. How are dynamometers classified? Explain the advantages and limitations of each. 20

PART-B

- Q.5 What are different factors which influence the choice of method used for measurement of flow? Describe the application of flow measurement in detail. 20
- Q.6 Explain the construction and working principle of following:
- a) Bi-metallic thermometers.
  - b) Liquid in glass thermometers.
  - c) Electrical resistance thermometers.
  - d) Total radiation pyrometers.
- 5x4
- Q.7 Differentiate between tools and equipments. Explain the working of battery hydrometer, armature growler and battery high discharge cell tester in detail. 10

End Semester Examination, Dec. 2016  
B. Tech.—Seventh/ Eighth Semester  
COMPUTER AIDED VEHICLE DESIGN (AU-802)

Time: 3 hrs.

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Answer the following questions:

- a) Write criteria for selection of number of cylinders for IC engine.
- b) Write various cylinder arrangements used for IC engine?
- c) Classify the vehicle according to its body shapes.
- d) What is the importance of downward visibility?
- e) Describe two practical objectives of aerodynamics.
- f) What is meant by lift and pitching?
- g) What are the factors affecting vehicle acceleration?
- h) What information we get from performance curves?
- i) What are the general characteristics of sheet metal used for a vehicle body construction?
- j) What are the various steps to be followed for painting process? 2 × 10

PART-A

- Q.2 a) Explain how varying number of cylinders of an IC engine affects its performance. 10
- b) Discuss design and operating variables affecting performance and emission of an SI engine. 10
- Q.3 a) Classify the vehicle according to its body shapes. 10
- b) Discuss the different methods of improving visibility. 10
- Q.4 a) Explain how air flow visualization test can be conducted using a wind tunnel. 10
- b) Illustrate the different forms of aerodynamic drag. 10

PART-B

- Q.5 Explain in brief the performance curves of a vehicle. What information can be obtained from them? 20
- Q.6 a) Define mean effective pressure, indicated horse power, brake horse power, frictional horsepower, compression ratio, piston displacement. 10
- b) Explain how side thrust on cylinder walls affect performance of an IC engine. 10
- Q.7 a) Explain about the modern painting processes for vehicle bodies. 10
- b) How selections of material for a car body affect its performance? 10



End Semester Examination, Dec. 2016  
B. Tech.– SixthSemester  
EMERGING AUTOMOBILE TECHNOLOGIES (AU-817)

Time: 3 hrs.

Max Marks:100

No. of pages:1

Note: Attempt FIVE questions in all;Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

- Q.1
- a) Explain the term product development management.
  - b) Enlist features to be considered for car designed for aging population.
  - c) Define proton exchange membrane fuel cell.
  - d) How fuel cell is better than battery?
  - e) Why there is requirement of 42 V systems in automobile?
  - f) What is the difference between turbocharging and supercharging?
  - g) What is the need for hybrid electric vehicle in today's era?
  - h) How hybrid electric vehicle reduce the emission problem?
  - i) What is integrated starter generator?
  - j) What is x-by wire technology?
- 2×10

PART-A

- Q.2 Discuss challenges of automobile industry for 21<sup>st</sup> century vehicles in terms of:
- a) Energy.
  - b) Environment.
  - c) Safety.
  - d) Urban mobility (parking and congestion).
- 5×4
- Q.3
- a) How production of electron in a fuel cell is different from that of battery? Explain giving chemical reaction. 10
  - b) Explain the following:
    - i) Solid oxide fuel cell.
    - ii) Molten carbonate fuel cell. 10
- Q.4
- a) Explain variable value timing technology. How can this be achieved? 10
  - b) Explain gasoline direct fuel injection system. How does it enhance the performance of engine? 10

PART-B

- Q.5 Discuss need and suitability of hybrid electric vehicle in term of:
- a) Energy.
  - b) Environment.
  - c) For urban transportation. 20
- Q.6
- a) Discuss the need of new energy storage media in detail. 10
  - b) How is integrated starter generator beneficial? 10
- Q.7
- a) Explain semi-active and fully active suspension system in detail. 10
  - b) Discuss use of micro-controller in automobiles. How does it enhance the performance of automobiles? 10

End Semester Examination, Dec. 2016  
B. Tech.–First Semester  
ELEMENTS OF BIOTECHNOLOGY (BT-101A)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Briefly answer:

- a) What is metapopulation?
- b) Define speciation?
- c) Name different types of Endoplasmic reticulum?
- d) Who proposed the concept of Cell Theory?
- e) Why are Chromosome called 'hereditary vehicles'?
- f) What is Turner's syndrome?
- g) Enumerate the difference between saturated and unsaturated fat.
- h) Mention the essential features of DNA replication.
- i) What is the importance of DNA vaccines?
- j) Enumerate any three objectives of bioethics.

2x10

PART-A

- Q.2 a) Explain various stages of Meiosis I. 10
- b) Enumerate the various differences between Mitosis and Meiosis 10
- Q.3 a) How does adaptation help in the process of evolution of life forms? 10
- b) State the theory of 'Abiogenesis'. 10
- Q.4 a) Describe the mechanism of crossing over. 10
- b) Mention different mechanisms of chromosomal sex determination. 10

PART-B

- Q.5 a) What do you mean by Biomolecules? 3
- b) How are glycosidic bonds formed? Enumerate functions of carbohydrate. 7
- c) Explain different levels of protein structure. 10
- Q.6 a) Discuss the advantages and disadvantages of transgenic plants. 10
- b) What are cloning vectors? Give examples. 10
- Q.7 a) Enlist the entrepreneurship potentials of biotechnology. 10
- b) What is importance of Biotechnology in human health? 5
- c) Give silent features of "Cartagena Protocol on Biosafety". 5

End Semester Examination, Dec. 2016  
B. Tech.–First Semester  
ELEMENTS OF BIOTECHNOLOGY (BT-101A)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

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- a) What is metapopulation?
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2x10

PART-A

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# End Semester Examination, Dec. 2016

## B. Tech.–Second Semester BIOMOLECULES(BT-201)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Answer briefly:

- A) WHAT PROPERTY OF WATER CAN EXPLAIN THE ABILITY OF INSECTS AND SPIDERS TO WALK ON POND'S SURFACE?
- B) WHAT ARE NEUTRALIZATION REACTIONS?
- C) DEFINE GLYCOSIDIC LINKAGE. WITH THE HELP OF AN EXAMPLE SHOW ITS FORMATION.
- D) WHAT IS THE ROLE OF SDS IN SDS-PAGE?
- E) DOES KETOTRIOSE EXIST IN D OR L FORM? STATE REASON OF YOUR ANSWER.
- F) WITH THE HELP OF AN EXAMPLE WRITE DOWN THE COMPOSITION AND STRUCTURE OF SPHINGOPHOSPHOLIPID.
- G) NAME AND WRITE DOWN THE STRUCTURE OF COMPOUND WHOSE METABOLIC PRECURSOR IS ARACHIDONIC ACID AND HAS A ROLE IN STIMULATION OF SMOOTH MUSCLE CONTRACTION.
- H) NAME THE SCIENTIST WHO COINED THE TERM NUCLEIC ACIDS. ON THE BASIS OF WHICH PROPERTY IT WAS TERMED SO?
- I) WHAT DO YOU MEAN BY CENTRAL DOGMA? WHICH DISCOVERIES LED TO AN ALTERNATIVE DOGMA?
- J) STATE THE REASON WHY PURINE ALWAYS PAIRS WITH PYRIMIDINES IN DNA.

2x10

### PART-A

Q.2 A) WRITE IN DETAIL ABOUT THE DIFFERENT PROPERTIES OF WATER.

10

B) DERIVE HH EQUATION. WRITE DOWN THE SIGNIFICANCE OF HH EQUATION.

10

Q.3 A) WRITE IN DETAIL ABOUT THE CHROMATOGRAPHIC TECHNIQUE IN WHICH THE YIELD OF PURIFIED PROTEIN IS QUITE LOW HOWEVER THE SPECIFIC ACTIVITY OF THAT PURIFIED PROTEIN IS VERY HIGH.

B) WITH THE HELP OF AN EXAMPLE WRITE A NOTE ON ENANTIOMERS OF AMINO ACIDS. WHICH OF THE ISOMER FORM IS FOUND IN NATURALLY FORMING PROTEINS? NAME AND DRAW THE STRUCTURE OF ANY ONE AMINO ACID WHICH DOES NOT EXIST AS ENANTIOMERS.

C) WRITE ABOUT THE CLASSIFICATION OF PROTEINS ON THE BASIS OF THEIR COMPOSITION.

D) WRITE A NOTE ON VARIOUS INTERACTIONS AND BONDS INVOLVED IN FORMATION OF TERTIARY STRUCTURE OF PROTEINS.

5x4

Q.4 a) Write in detail about the classification of enzymes on the basis of reaction they perform.

10

b) Derive Michaelis-Menten equation.

10

### PART-B

Q.5 Write notes on:

- a) Starch.
- b) Cyclization of aldohexose.
- c) Glycosaminoglycans (GAGs).
- d) Functions of carbohydrate.

5x4

- Q.6 a) Write in detail about the classification of lipids on the basis of their functions. 10
- b) Name and draw the structure of compound that is considered to be the immediate precursor of glycolipids. Write in detail about the different types of Glycolipids. 10
- Q.7 a) Compare the essential and contrasting features of B-DNA, A-DNA and Z-DNA. 10
- b) Write in detail about the structure of RNA that carries activated amino acids at protein factory site. 10

End Semester Examination, Dec. 2016  
B. Tech.–Second Semester  
GENETICS AND CYTOGENETICS (BT-202)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

- Q.1
- a) What is gene?
  - b) How chromosomes are classified on the basis of the number of centromeres?
  - c) What is inversion? Mention its types and significance in brief.
  - d) What is an accessory chromosome?
  - e) What do you understand by Balbiani rings?
  - f) What is linkage?
  - g) Explain chromosome mapping.
  - h) Write a brief note on 'Plasmon and plasmagenes'.
  - i) What is genetic drift?
  - j) Write a brief note on 'Founder effect in population genetics'. 2x10

PART-A

- Q.2 Differentiate between the following:
- a) Monohybrid cross and Di hybrid cross. 10
  - b) Test cross and back cross. 10
- Q.3 What is chromosomal aberration? Explain the types and significance of structural and numerical changes occur due to chromosomal aberration. 20
- Q.4
- a) Explain the structure and function of lamp brush chromosomes. 10
  - b) Differentiate between 'euchromatin' and 'heterochromatin'. 10

PART-B

- Q.5
- a) What are mutagens? Describe the mode of action of any two chemical mutagens. 10
  - b) Differentiate between 'transversion' and 'point mutation'. 10
- Q.6
- a) What is cytoplasmic inheritance? Explain the inheritance of kappa particles in paramecium. 10
  - b) Write a note on 'cytoplasmic inheritance in haploid'. 10
- Q.7
- a) Describe Hardy-Weinberg law with an example and also mention its salient features in detail. 10
  - b) Write short notes on the following:
    - i) Gene pool.
    - ii) Gene frequency and genotype frequency. 5x2

# End Semester Examination, Dec. 2016

## B. Tech.– ThirdSemester CELL BIOLOGY(BT-301A)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Answer briefly

- a) How do signaling pathways crosstalk with each other?
- b) What is the role of ribosomal RNA in translation?
- c) Differentiate between active and passive transport.
- d) What is the composition of extracellular matrix?
- e) What do you mean by aponeurosis?

4x5

### PART-A

- Q.2 a) How transport of metabolites take place across cell membrane. 10
- b) Explain the concept of fluidity of membranes in detail. 10
- Q.3 a) What will happen if vacuole is not present in the cell? 6
- b) Explain how the ultrastructure of cilia and flagella relate to their functions. 14
- Q.4 a) Comment on: 'Mitochondria resemble bacteria'. 10
- b) Write a short note on cell cycle and its regulation in detail. 10

### PART-B

- Q.5 Define signal transduction. How G protein linked receptors activate secondary messengers for cell communication? Explain with suitable diagrams and examples. 20
- Q.6 What are the types of cancer? Describe the process and mechanism of multistage carcinogenesis with suitable diagrams. 20
- Q.7 a) What are the different structural proteins present in a muscle cell? 10
- b) Explain the mechanism of contraction and relaxation in a smooth muscle cell. 10

End Semester Examination, Dec. 2016  
B. Tech.– Third Semester  
MICROBIOLOGY (BT-302 / BT-302A)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

- Q.1
- a) What is the difference between tenericutes and gracilicutes?
  - b) What are the contributions of Robert Koch in the field of microbiology?
  - c) How archaeobacterial cell wall differs from the eubacterial wall?
  - d) What is pasteurization?
  - e) What is a chemostat?
  - f) What is thermal death point and thermal death time?
  - g) What is an Hfr strain?
  - h) What is the ATP yield in glycolysis?
  - i) What do you understand by the term: 'incineration'?
  - j) What is a minimal media?

2x10

PART-A

- Q.2
- a) Give a brief account of various molecular approaches used for the classification of bacteria. 12
  - b) How Haeckel's three kingdom concept is different from Whittaker's five kingdom classification? 8
- Q.3
- a) Discuss the various inclusion bodies present in bacteria along with their importance to the cell. 10
  - b) Give the salient features of Rickettsiae and chlamydiae. How these are different from viruses? 10
- Q.4
- a) How sporulation occurs in bacteria? Enumerate the major differences between a spore and vegetative cell. 8
  - b) Explain the methods for the measurement of bacterial growth. 12

PART-B

- Q.5
- a) DNA from a strain of *Bacillus subtilis* with genotype  $tyr^+ trp^+$  is used to transform a highly competent recipient strain of genotype  $tyr^- trp^-$ . The following of transformed cells were recovered:  
 $Tyr^+ = 312$   
 $Trp^+ = 154$   
 $Tyr^+ Trp^+ = 354$   
What do these results suggest about the linkage of *tyr* and *trp* genes. 8
  - b) Why generalized transduction can transfer any gene, but specialized transduction is restricted to only a small set? Explain in detail. 12
- Q.6
- Write short notes on:
- a) Pentose phosphate pathway. 10
  - b) Glycolysis. 10



- Q.7 a) Explain the different antimicrobial agent's mode of action with respect to their cellular targets. Give some examples of each. 10
- b) Comment on alcohols, phenols & its derivatives and aldehydes as antimicrobial agents 10

End Semester Examination, Dec. 2016  
B. Tech.– Third Semester  
BIOCHEMISTRY (BT-303C)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Answer briefly

- a) Differentiate between Catabolism and Anabolism.
- b) What are the causes and symptoms of Phenylketonuria?
- c) What is the role of Pyruvate dehydrogenase complex?
- d) How do uncouplers inhibit oxidative phosphorylation?
- e) How are sterols different from steroids?

5x4

PART-A

- Q.2 a) What do you understand by energy transformation? Explain first and second law of thermodynamics in detail. 10
- b) How ATP participates in a metabolic network and what is the significance of it? 10
- Q.3 a) Describe the reactions of Urea cycle. 10
- b) What are the fates of Urea? 5
- c) Name the disease caused by elevated ammonia level in blood. What are the consequences of the enzyme deficiencies in the Urea cycle? 5
- Q.4 a) Write down the steps involved in catabolism of Glucose. 10
- b) What is the net ATP yield for Glycolysis? 5
- c) Describe the fates of Pyruvate from Glycolysis. 5

PART-B

- Q.5 a) Describe the various steps involved in Electron transport through ETC. 10
- b) What is the role of mitochondria in ETC? 5
- c) How ATP is produced in ETC? 5
- Q.6 a) Describe the steps of fatty acid biosynthesis. 10
- b) Elaborate thiolase reaction in fatty acid  $\beta$  oxidation. 5
- c) What are the characteristics of ketosis? 5
- Q.7 a) Explain the De Novo synthesis of Purine nucleotides. 10
- b) Briefly describe catabolism of Purine nucleotides. 10

# End Semester Examination, Dec. 2016

B. Tech.– Third Semester

## BIOANALYTICAL TECHNIQUES (BT-305B)

Time: 3 hrs

Max Marks: 100

No. of pages 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

- Q.1
- a) Differentiate between 'zero shift' and 'span error'. 3
  - b) What are the factors that affect sedimentation velocity of a particle falling through a fluid under gravity? 3
  - c) How is resolution related to wavelength of light in an optical microscope? 2
  - d) Explain the separation of organelles using density gradient centrifugation. 3
  - e) Enlist applications of gas chromatography. 2
  - f) What are the advantages of 2D gel electrophoresis? 2
  - g) How do quenchers affect scintillation counter measurements? 2
  - h) What are safety issues in handling radioactive isotopes? 3

### PART-A

- Q.2
- a) Describe in detail the following performance indicator of a measuring device:
    - i) Sensitivity. ii) Linearity. iii) Threshold. iv) Resolution.
    - v) Scale readability. vi) Accuracy. vii) Precision. 2x7
  - b) What are random errors? How are random errors minimized? 6
- Q.3
- a) Describe the construction and working of a fluorescence microscope. Enlist the applications of fluorescence microscopy. Draw a well labeled diagram. 12
  - b) Differentiate between:
    - i) Isopycnic and rate zonal centrifugation.
    - ii) Magnification and resolution. 4x2
- Q.4
- a) Describe the construction and working of gas chromatograph in detail. 10
  - b) Discuss the parameters that result in band broadening according to the Van Deemter theory. 5
  - c) How can one determine the molecular weight of proteins using gel filtration (size exclusion) chromatography? 5

### PART-B

- Q.5
- a) Describe in detail the principle, reagents and procedure for SDS-PAGE electrophoresis. 12
  - b) What is capillary electrophoresis? 8
- Q.6
- a) Explain Lambert Beer's law. 4
  - b) Describe the components of a UV/Visible spectrophotometer. Draw a well labeled diagram. 7
  - c) What are the typical applications of following types of spectroscopy?
    - i) Infrared spectroscopy.
    - ii) NMR spectroscopy.
    - iii) ESR spectroscopy. 9
- Q.7
- Write notes on the following:
- a) Ionizing radiation.
  - b) Geiger Mueller counter.
  - c) Radioactive waste management.
  - d) Applications of radioactive techniques. 5x4

# End Semester Examination, Dec. 2016

B. Tech. – Third Semester

## BIOCHEMICAL CALCULATIONS (BT-306B)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Answer in brief:

- What does mole and volume fraction stand for? Give equations.
- What are buffers? Name three commonly used buffers.
- What are alpha, beta and gamma particles?
- What is ninhydrin test? Where is it used?
- What are different types of enzyme inhibitions?

4x5

### PART-A

- Q.2
- Calculate the molarity and normality of 5 g NaCl dissolved in 500ml water. What will be its molality in 250kg of water? 6
  - What does pH and pK stand for? Derive the equation showing their relationship. 8
  - What does ppm and ppt stand for? Explain. Caustic soda flakes is found to contain 60 ppm silica as impurity. Convert this impurity into mass%. 6
- Q.3
- If an element belongs to group 13 and emits alpha radiations then what will be the position of new daughter element in the periodic table? Amongst the alpha, beta and gamma particles which are the lightest particles and most penetrating. 8
  - How does excess reactant play a role in reaction conversions? Explain briefly. 6
  - What do you mean by yield? Calculate yield% of  $H_2$  for the following reactions:  
 $CH_4 + H_2O \rightarrow CO + 3H_2$   
 $CH_4 + 2H_2O \rightarrow CO_2 + 4H_2$  6
- Q.4
- Define the following:
    - Heat of hydrogenation.
    - Sensible heat.
    - Enthalpy.
    - Molar heat capacity.
    - Heat of fusion. 10
  - Calculate amount of heat lost to surroundings when 0.25kg of steam at  $100^\circ C$  condenses to water at  $75^\circ C$ . Given latent heat of vaporization =  $2.3 \times 10^6 J/Kg$ , specific heat capacity of steam =  $2 \times 10^3$ , specific heat capacity of ice =  $2.1 \times 10^3$ , specific heat capacity of liquid water =  $4.2 \times 10^3$ . 10

### PART-B

- Q.5
- $C^{14}$  has a half-life of 5700 years. Calculate fraction of  $C^{14}$  atoms that decays (i) per year (ii) per minute. 10
  - Explain two different tests that are carried out to detect the presence of amino acids. 10
- Q.6
- Diagrammatically explain the functioning of a spectrophotometer. 5
  - How can protein concentration be spectrophotometrically determined? Discuss briefly. 5
  - What is saponification number? Determine the saponification number of palmitodistearin:  $Palmitodistearin + 3 KOH \rightarrow glycerol + K-palmitate + 2 K-stearate$ . 10
- Q.7
- Discuss and derive Michaelis-Menten equation. 8

- b) What does  $K_m$  stand for? Derive the equation for the same. 6  
 c) What is feedback inhibition? How does it function? 6

## End Semester Examination, Dec. 2016

B. Tech. – Third Semester

### BIOCHEMICAL CALCULATIONS (BT-306B)

Time: 3 hrs

Max Marks: 100

No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Answer briefly:

- a) What does mole and volume fraction stand for? Give equations.
- b) What are buffers? Name three commonly used buffers.
- c) What are alpha, beta and gamma particles?
- d) What is ninhydrin test? Where is it used?
- e) What are different types of enzyme inhibitions?

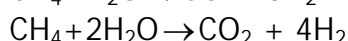
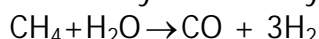
5x4

### PART-A

- Q.2 a) Calculate the molarity and normality of 5 g NaCl dissolved in 500ml water. What will be its molality in 250kg of water? 6  
 b) What does pH and pKa stand for? Derive the equation showing their relationship. 8  
 c) What does ppm and ppt stand for? Explain. Caustic soda flakes is found to contain 60 ppm silica as impurity. Convert this impurity into mass%. 6

- Q.3 a) If an element belongs to group 13 and emits alpha radiations then what will be the position of new daughter element in the periodic table? Amongst the alpha, beta and gamma particles which are the lightest particles and most penetrating 8

- b) How does excess reactant play a role in reaction conversions? Explain briefly. 6
- c) What do you mean by yield? Calculate yield% of  $H_2$  for the following reactions:



6

- Q.4 a) Define the following:  
 i) Heat of hydrogenation  
 ii) Sensible heat  
 iii) Enthalpy  
 iv) Molar heat capacity  
 v) Heat of fusion

10

- b) Calculate amount of heat lost to surroundings when 0.25kg of steam at  $100^\circ C$  condenses to water at  $75^\circ C$ . Given latent heat of vaporization =  $2.3 \times 10^6 J/Kg$ , specific heat capacity of steam =  $2 \times 10^3$ , specific heat capacity of ice =  $2.1 \times 10^3$ , specific heat capacity of liquid water =  $4.2 \times 10^3$ . 10

### PART-B

- Q.5 a)  $C^{14}$  has a half life of 5700 years. Calculate fraction of  $C^{14}$  atoms that decays (i) per year (ii) per minute. 10  
 b) Explain two different tests that are carried out to detect the presence of amino acids. 10

- Q.6 a) Diagrammatically explain the functioning of a spectrophotometer. 5  
 b) How can protein concentration be spectrophotometrically determined? Discuss briefly. 5

c) What is saponification number? Determine the saponification number of palmitodistearin:  $\text{Palmitodistearin} + 3 \text{ KOH} \rightarrow \text{glycerol} + \text{K-palmitate} + 2 \text{ K-stearate}$  10

Q.7 a) Discuss and derive michaelis menten equation. 8  
b) What does  $K_m$  stand for? Derive the equation for the same. 6  
c) What is feedback inhibition? How does it function? 6

End Semester Examination, Dec. 2016  
B. Tech.– Third Semester  
BIOCHEMICAL CALCULATIONS (BT-306C)

Time: 3 hrs

Max Marks: 100

No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Answer in brief:

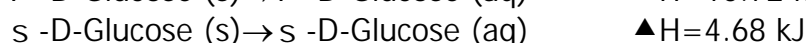
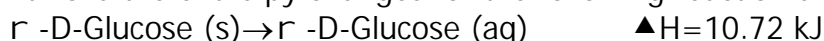
- What mass of  $\text{MgBr}_2$  would be required to prepare 720ml of a 0.939M aqueous solution? Given molecular weight of Mg= 24.305, Br= 79.9.
- What is half-life period of a radioactive substance? Derive the equation.
- What is Gas constant? Write its equation and give its value for gases.
- Name four natural peptides with their source and functions.
- Differentiate between nucleoside, nucleotide and nucleic acid. Give examples.

5x4

PART-A

- Q.2
- A saturated solution of salicylic acid ( $\text{HOC}_6\text{H}_4\text{COOH}$ ) in methanol contains 64kg salicylic acid per 100kg of methanol at 298.15 K. Find (i) mass% (ii) mol% composition of the solution. 8
  - In a microbiology experiment, the students performed a three step 1:100 serial dilution of a bacterial culture. What is the final dilution of the broth? Also, what is the new concentration of bacteria in the new solution? 6
  - What is the difference between a basic and derived unit? Explain with examples. 6
- Q.3
- Discuss briefly acid base concepts given by Arrhenius, Bronsted-lowry and Lewis. 8
  - Derive Henderson Hasselbach equation. 6
  - What is buffer capacity? Give its equation. What is its acceptable range? 6

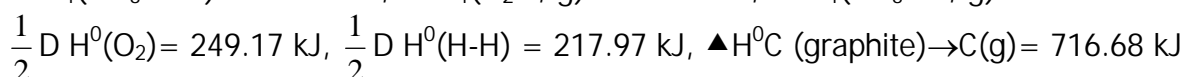
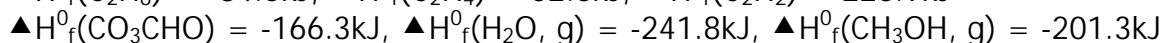
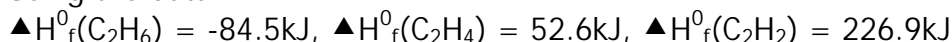
Q.4 a) At 25°C the enthalpy changes for the following reaction are given:



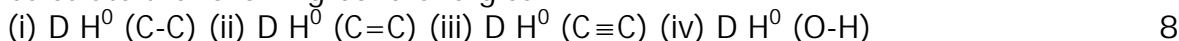
Calculate  $\Delta H$  for  $r\text{-D-Glucose (s)} \rightarrow s\text{-D-Glucose (s)}$  6

b) Write short notes on: (i) heat capacity of solids (ii) heat capacity of liquids and solutions 6

c) Using the data:



Calculate the following bond energies:



PART-B

- Q.5
- Discuss briefly four different chemical tests carried out for the analysis of amino acids. 12
  - Write the properties of  $r$ ,  $s$  and  $x$  radiations. 8

- Q.6 a) Define turnover number. How is it related to catalytic cycle? 6
- b) What fraction of  $V_{\max}$  is observed at (i)  $[S]=4 K_m$  (ii)  $[S]=5 K_m$  (iii)  $[S]=6 K_m$  (iv)  $[S]=9 K_m$  (v)  $[S]=10 K_m$  10
- c) What are the different factors affecting enzyme kinetics? 4
- Q.7 a) Discuss the principle of fluorometry. How is it different from spectrophotometer? 6
- b) Explain diagrammatically the functioning of a polarimeter. 6
- c) How is transmission affected by change in either concentration or path length of the sample solution? If a sample of Formula Weight=250g of concentration 2 g/L transmits 60% of incident light when placed in a cuvette of path length 1 cm. Calculate % transmission if concentrations are: (i) 1 g/L (ii) 6 g/L. 8



End Semester Examination, Dec. 2016  
B. Tech.–Third Semester  
CONCEPTS IN IMMUNOLOGY (BT-307)

Time: 3 hrs.

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Answer the following in brief:

- a) What are haptens?
- b) Draw the labelled diagram of IgG and IgM.
- c) Define 'polyclonal antibodies'.
- d) Write the principle of Ouchterlony double diffusion test.
- e) What is an epitope?
- f) Name different types of vaccines.
- g) What is hypersensitivity?
- h) How basophil is different from neutrophil?
- i) Explain an autoimmune disorder.
- j) What is passive immunization?

2 × 10

PART-A

Q.2 a) Differentiate between the following:

- i) Innate and adaptive immunity.
- ii) Mast cells and dendritic cells.
- iii) Thymus and spleen.

4 × 3

b) Discuss about the MAET with the help of a diagram.

8

Q.3 a) Explain the difference between isotypes, idiotypes and allotypes of antibodies.

9

b) What is complement system? Explain an alternate complement system.

8

c) Differentiate between humoral and cellular immune response.

3

Q.4 Write notes on the following:

- a) Immunoglobulin light gene.
- b) Major histocompatibility complex (MHC).
- c) Human leucocytes antigen (HLA) restriction.

6

8

6

PART-B

Q.5 a) Explain the production and selection of hybridomas in detail.

14

b) How complete Freund's adjuvant is different from incomplete Freund's adjuvant?

6

Q.6 Write principle, procedure and applications of following techniques:

- a) RID.
- b) Direct ELISA.
- c) Indirect immunofluorescence.

6

8

6

Q.7 a) Define 'hypersensitivity'. How delayed type hypersensitivity can occur?

10

b) What are DNA vaccines?

5

c) Write a short note on: 'tumor immunology'.

5

End Semester Examination, Dec. 2016  
B. Tech. – Fourth Semester  
MOLECULAR BIOLOGY(BT-401A)

Time: 3 hrs

Max Marks:100

No. of pages:1

Note: Attempt FIVE questions in all;Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Briefly answer:

- a) What is a microsatellite DNA sequence?
- b) How does denaturation depend on the GC content of the DNA?
- c) What do you mean by photoreactivation?
- d) Why is an RNA primer necessary for DNA replication?
- e) Where are promoters located on DNA?How do promoters affects gene expression?
- f) What will happen if a mutation is done in DNA polymerase that eliminates the 3'-to-5' exonuclease activity?
- g) Give examples of mutations that lead to constitutive expression of lac genes.
- h) What is the significance of ubiquitination?
- i) What is self-splicing?
- j) What is macroautophagy?

2×1

PART-A

Q.2 What is a genome? How does the complexity of bacterial genomes differ from that of eukaryotic genomes? How was this complexity elucidated? 20

Q.3 A) WHAT IS SEMI CONSERVATIVE REPLICATION? HOW IT WAS PROVED? 10  
B) LIST DOWN THE STEPS INVOLVED IN THE REPLICATION OF THE ENDS OF THE CHROMOSOME. 10

Q.4 Explain the following:  
a) Promoters recognized by RNA polymerase I and III. 8  
b) Splicing of tRNA. 6  
c) Capping and its significance. 6

PART-B

Q.5 a) What is an operon? Explain the regulation of synthesis of tryptan in E.coli cell. 15  
b) What causes glucose effect to occur? 5

Q.6 a) Discuss the post translational modifications that alter the location of a protein. 10  
b) How co-translational translocation of proteins takes place? 10

Q.7 What are transposons? Give an account of different types of transposons in prokaryotes along with the mechanism of transposition. 20

End Semester Examination, Dec. 2016  
B. Tech.–FourthSemester  
IMMUNOLOGY(BT-402A)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

- Q.1 Briefly answer the following:
- a) How antigenicity is different from immunogenicity?
  - b) What is the difference between eosinophils, neutrophils and basophils?
  - c) What are interferons?
  - d) What are haptens?
  - e) What features of secondary immune response distinguishes it from primary immune response?
  - f) What is antibody dependent cell mediated cytotoxicity?
  - g) Into which main effector T cell subsets can naïve CD4<sup>+</sup> and CD8<sup>+</sup> T differentiate upon activation?
  - h) Name the types of hypersensitivity reactions that can be induced by penicillin.
  - i) How IgA differs from IgG?
  - j) What are anaphylatoxins?
- 2x10

PART-A

- Q.2 a) Discuss the major leucocytes and their primary functions in detail. 12  
b) What are primary lymphoid organs? Discuss the structure and function of any one in detail. 8
- Q.3 What is complement system? Discuss the different pathways by which it can be activated. 20
- Q.4 What molecules are presented on MHC-I and MHC-II respectively? Which cells express these surface receptors? 20

PART-B

- Q.5 a) Discuss the immune response generated against the viral infections. 10  
b) How hybridomas are generated? 10
- Q.6 Explain the following in brief:
- a) Sandwich ELISA.
  - b) Ouchterlony double diffusion.
  - c) Flow cytometry.
  - d) RIA.
- 5x4
- Q.7 What mechanisms are responsible for the induction of autoimmunity? Discuss the approaches that can be used for the treatment of autoimmune diseases. 20

End Semester Examination, Dec. 2016  
B. Tech.– Fourth Semester  
INDUSTRIAL MICROBIOLOGY (BT-403A)

Time: 3 hrs.

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

Q.1 Write short notes on:

- a) Para sexual cycle.
- b) Bt-Toxin: mode of action.
- c) Feedback repression.
- d) Differentiate between 'primary' and 'secondary metabolites'.
- e) What are hops? Give their significance.

4 × 5

PART-A

- Q.2 a) Give the range of fermentation process in detail. 10  
b) What is fermentation process? Explain the historical aspect of industrial microbiology in detail. 10
- Q.3 a) How does a parasexual cycle contribute toward strain improvement process? 10  
b) Explain the isolation of industrially important microorganisms. 10
- Q.4 a) Explain the production of vinegar through various fermentation methods. 10  
b) What are alcoholic beverages? Explain the production of beer in brief. 10

PART-B

- Q.5 a) What are antibiotics and how do they work? Name the scientist who discovered the first penicillin antibiotic. 10  
b) Explain the production of vitamin B12. 10
- Q.6 a) Define 'bio-pesticides'. How are they superior to chemical pesticides? 10  
b) What is single cell protein? Why is the use of single cell protein not recommended for humans? 10
- Q.7 a) Give an account of critical parameters pertaining to fermentation economics. 10  
b) Explain some case studies for fermentation of recombinant proteins. 10

End Semester Examination, Dec. 2016  
B. Tech. (Biotechnology)— Fourth Semester  
BASICS OF CHEMICAL ENGINEERING (BT-404A)

Time: 3 hrs.

Max Marks: 100

No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

- Q.1 a) In the hydrolysis of an organic chloride in presence of large excess of water, the rate of the reaction doubles, when the concentration of the organic chloride is doubled. State the molecularity and order of the reaction.  

$$RCl + H_2O \rightarrow ROH + HCl$$
 3
- b) What is activation energy? How does reaction temperature affect activation energy? 3
- c) Define and give units of dynamic viscosity. 3
- d) Define a black body. 2
- e) How is natural convection different from a forced convection? 3
- f) What are the applications of drying? 3
- g) What are the common errors in measurement? 3

PART-A

- Q.2 a) Describe the kinetics of first order reactions. 5
- b) The reaction  $2X(g) + Y(g) \rightarrow 3Z(g)$  has the rate expression  $\text{rate} = k[X]^2[Y]^0$ . The concentration of X is increased by a factor of three and the concentration of Y is increased by a factor of two. By what factor will the reaction rate increase? 5
- c) Describe the working and design of continuous stirred tank reactor. 5
- d) Explain the non-idealities existing in packed bed reactors. 5
- Q.3 a) Derive the basic equation of fluid statics. 5
- b) Draw and explain briefly the rheograms for:  
 i) Bingham body. 2½ × 2  
 ii) Newtonian fluid. 2½ × 2
- c) Determine the Reynolds number for Glycerin at 25°C (density 1258 kg/m<sup>3</sup>, viscosity 0.96 Pa.s) flowing through a pipe having diameter of 150mm at a velocity of 3.6 m/s. 5
- d) Differentiate between the following:  
 i) Compressible and incompressible fluids. 2½ × 2  
 ii) Intensive and extensive properties. 2½ × 2
- Q.4 a) What are the factors that affect heat transfer through convection? How can rate of heat transfer by convection be increased? 5
- b) Describe in detail construction and working of shell and tube heat exchangers. 15

PART-B

- Q.5 a) State and explain Fick's law of diffusion. How can rate of mass transfer by diffusion be increased? 8
- b) Discuss Gas-liquid mass transfer and derive equation governing the same. 12
- Q.6 a) Describe in detail the following:  
 i) Working principle. 3  
 ii) Construction. 3

- |  |   |
|--|---|
| iii) Applications of any one type of dryer.  | 2 |
| b) Explain Mier's theory of crystallization. | 6 |
| c) What is fractional distillation?          | 6 |

Q.7 Write short notes on:

- a) Working principle of pH meter.
- b) Basic feedback control.
- c) Principles of measurement.
- d) Venturimeter.

5 × 4

End Semester Examination, Dec. 2016  
B. Tech.— Fourth Semester  
THERMODYNAMICS OF BIOPROCESS (BT-405A)

Time: 3 hrs.

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

- Q.1 Briefly explain the following:
- a) Free energy of formation.
  - b) Chemical coupling.
  - c) Flux and force.
  - d) Passive transport across membrane.
  - e) Diffusion.

4×5

PART-A

- Q.2 a) "Refrigerators and heat pumps are reversed heat engines". Explain. Derive an expression for C.O.P of a heat pump. 15  
b) Differentiate between Enthalpy and Entropy. 5
- Q.3 a) What is Henry's Law? Explain the relationship between Raoult's and Henry's Law.  
b) Explain equilibrium constant ( $K_c$ ) in homogenous and heterogeneous equilibrium. 10×2
- Q.4 a) Write in detail about Gibb's energy in an open system.  
b) Explain biological concepts of thermodynamics. 10×2

PART-B

- Q.5 a) What do you understand by the term 'entropy'? Explain the concept of entropy production. 12  
b) What is Onsager's reciprocal relation? 8
- Q.6 Explain the following:  
a) Partition function.  
b) Cooperative transitions. 10×2
- Q.7 a) Explain the thermodynamics of biological systems by taking an example of oxidative phosphorylation.  
b) What do you understand by routes to chaos? 10×2

End Semester Examination, Dec. 2016  
B. Tech.— Fourth Semester  
BIO INFORMATION AND COMPUTER APPLICATION (BT-406)

Time: 3 hrs.

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

- Q.1 a) Distinguish between DOS and Windows operating system.  
b) How holoproteins are different from heteroproteins?  
c) Briefly state about motile protein with suitable examples.  
d) What is the application of multiple sequence alignment? 5 × 4

PART-A

- Q.2 Describe various types of database modeling and architecture adopted for biological database designing. Highlight the main technical features of Genbank database. 20
- Q.3 a) Explain the Sanger sequencing method with an example. 10  
b) How ESTs are generated? Explain their applications in detail. 10
- Q.4 a) Differentiate between internet and intranet. Also explain various types of network topologies. 15  
b) Explain LAN, WAN and MAN with examples. 5

PART-B

- Q.5 a) Explain the importance of gap in sequence alignment. 5  
b) Distinguish between Needleman Wunsch and Smith Waterman algorithm and calculate sequence alignment globally using dynamic programming method when:  
 $S_{ij}(\text{Match}) = +2$   
 $S_{ij}(\text{Mismatch}) = -1$   
 $W(\text{Gap penalty}) = 0$   
  
Seq. 1:- A T C G A  
Seq. 2:- A C C G A 15
- Q.6 Explain the BLAST method / Algorithm and distinguished it from FASTA method. Specify the algorithm frame work of both. 20
- Q.7 What is the importance of protein 3-D structure prediction? Mention the method with detail steps with suitable tool for homology modeling. 20



End Semester Examination, Dec. 2016  
B. Tech.–Fifth Semester  
RECOMBINANT DNA TECHNOLOGY(BT-501A)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Answer briefly:

- a) What is the significance of methylation of bases in DNA?
- b) Differentiate between the cationic and anionic liposomes.
- c) What is the probe used in Western blotting?
- d) How plasmid amplification can be achieved?
- e) What is spi phenotype?
- f) Compare the sequence recognized by type-I, type-II and type-III restriction enzymes.
- g) What is the difference between a constitutive and inducible promoter?
- h) Name the probes used in real time PCR.

2½x8

PART-A

- Q.2 What is restriction and modification system? How was it discovered? How it protects the DNA of the cell from its own restriction enzymes? 20
- Q.3 a) What is the vector? Explain the salient features of different types of plasmid vectors along with the method of screening of gene of interest. 10
- b) How nutritional factors govern the development of lytic or lysogenic life cycle in lambda phage? Also explain the molecular basis of the same. 10
- Q.4 Give the different approaches to sequence a gene fragment along with the advantages and disadvantages of each. 20

PART-B

- Q.5 a) Differentiate the various types of viruses used in gene transfer? 14
- b) What is receptor mediated endocytosis? 6
- Q.6 a) Discuss the inducible promoters for the production of recombinant proteins in E.coli. 12
- b) How baculoviruses are used for the expression of a gene of interest in insect cell lines? 8
- Q.7 a) What are the basic hindrances of cleaning of biohazards in an oil spill? How microbes can help in the process? Explain with proper case studies. 14
- b) How PCR product can be quantified? 6

End Semester Examination, Dec. 2016  
B. Tech.–FifthSemester  
BIOREACTOR AND BIOPROCESS ENGINEERING (BT-502 / BT-502A)

Time: 3 hrs.

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

- Q.1
- a) Write a short note on "microbial and biochemical interaction with chemical engineering". 3
  - b) Distinguish between primary and secondary bioproducts with examples. 3
  - c) Enlist the different components parts of a bioreactor. 3
  - d) What are the reasons for non-ideal flow? 3
  - e) Write a short note on "tower bioreactors". 3
  - f) What are the antifoam agents? 3
  - g) What do you understand by GMP? 2

PART-A

- Q.2
- a) Explain upstream and downstream processing? 5
  - b) Write a short note on "the role of the biochemical engineer in biotechnology". 5
  - c) How batch culture is different from fed-batch culture? 10
- Q.3
- a) Explain Monod's kinetic model for batch fermentation in detail. 10
  - b) Write a note on "the mass and energy balance in bioreactor". 10
- Q.4
- a) Explain the factors to be considered for developing medium for a microbial cell. 10
  - b) What are the effects of contamination on large scale fermentation processes? 10

PART-B

- Q.5
- a) Mention some carbon sources for media formulation and also explain the factors influencing the choice of carbon. 15
  - b) Why growth factors are used in media formulation? 5
- Q.6
- a) Explain in detail about the filter sterilization. 10
  - b) Discuss batch sterilization processes in detail. 10
- Q.7
- a) Write a note on 'liquid-liquid mass transfer'. 10
  - b) How GMP could be necessary if there is a quality control laboratory? 5
  - c) Write a note on 'scale up of bioprocess'. 5

End Semester Examination, Dec. 2016  
B. Tech.–Fifth Semester  
ENZYME BIOTECHNOLOGY (BT-503 / BT-503A)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Answer in brief:

- a) What do you mean by salting out and how is it useful in concentrating proteins from cell extracts?
- b) Name the electrophoretic technique used for separation of proteins. Write its principle also.
- c) Differentiate between 'differential' and 'density gradient centrifugation'.
- d) What is membrane confinement? How can hollow fibers be used for enzyme immobilization?
- e) How can radio-chemical method be used for enzymatic analysis?
- f) Name any two cleavage agents in protein sequencing. Why is it mandatory to use two cleavage agents?
- g) How can immobilized enzymes be used in elimination of Nitrate pollution?
- h) How can rDNA technology be used in protein purification?
- i) Name the enzyme and its source which when used gives a faded look in stone washed jeans.
- j) What is the effect of temperature on enzyme activity? 2x10

PART-A

- Q.2 a) What do you understand by the term "enzyme catalysis"? Write about the different modes of enzyme catalysis. Elaborate on covalent catalysis with the help of an example. 12
- b) Spectrophotometry have been used in enzymatic analysis. Write about the principle and instrumentation of this technique. 8
- Q.3 a) Explain in detail about the various chromatographic techniques which can be used in protein purification. 12
- b) How is spectrofluorimetry different from spectrophotometry? Write about the principle and instrumentation of spectrofluorimetry. 8
- Q.4 Write notes on:
- a) Economic argument on enzyme immobilization. 5
  - b) Name the method that involves weak forces for enzyme immobilization. Name the carrier used and state advantages and disadvantages of the method. 5
  - c) Name the method that involves strongest bonds for enzyme immobilization. State advantages and disadvantages of this method. 5
  - d) Application of immobilized enzymes. 5

PART-B

- Q.5 a) Define 'enzyme kinetics' and derive Michaelis-Menten equation. 10
- b) Describe the design and working of packed bed reactor and fluidized bed reactor with the help of a diagram. 10
- Q.6 a) Write down the role of enzymes in food industry. 10
- b) As enzymes are being used in various segments of industry, discuss the enzyme business in India. 10

Q.7 a) Define the term "biosensors". What is the role of individual components of biosensors? Write in detail about at-least three different types of biosensors and their application in detail.

20

# End Semester Examination, Dec. 2016

## B. Tech.–Fifth Semester BIOINFORMATICS (BT-504)

Time: 3 hrs

Max Marks:100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part-A and TWO questions from Part-B. Each question carries equal marks.

Q.1 Answer Briefly:

- a) Enumerate the applications of bioinformatics.
- b) What do you mean by LAN?
- c) How primary database helps in homology modeling?
- d) Enlist two softwares for homology studies.
- e) What do you mean by secondary structure of protein?
- f) How PDB helps in structure prediction?
- g) Write Fasta format.
- h) What is the role of DDBJ?

2½x8

### PART-A

- Q.2 a) How internet, intranet and extranet are different from each other? 10
- b) Discuss any operating system in detail. 10
- Q.3 a) What do you mean by biological informations? 6
- b) Discuss any DNA sequencing method in detail. 14
- Q.4 a) Explain primary sequence database in detail. 10
- b) What do you mean by ER diagram? Discuss different symbols used in ER Diagram. 10

### PART-B

- Q.5 Align the given sequence using Smith Waterman algorithm for the given sequences CCCGTT and CGCGGT up to trace back using +1, -1 and 0 for match, mismatch and gap penalty respectively. 20
- Q.6 a) How MSA helps in establishing evolutionary relationship? 8
- b) Discuss different methods used for multiple sequence alignment in detail. 12
- Q.7 Write short notes on:
  - a) Fold recognition. 10
  - b) Challenges faced in integration of biological data. 10

# End Semester Examination, Dec. 2016

B. Tech.–FifthSemester

## DOWNSTREAM PROCESSING(BT-505A)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Briefly answer:

- a) 'Each step in downstream processing adds cost to the bio-product'. Give reasons. 3
- b) Explain the principle of a cell disruption with ultrasonication. 3
- c) What is a filter aid? Give examples. 3
- d) Give examples of following types of precipitants (i) Salt (ii) Solvents 2
- e) Differentiate between 'ultrafiltration' and 'microfiltration'. 3
- f) Define: i) resolution ii) void volume in column chromatography 3
- g) Differentiate between 'differential distillation' and 'fractional distillation'. 3

### PART-A

- Q.2
  - a) What is the scope of downstream processing? 6
  - b) Discuss the difficulties encountered in downstream processing of bioproducts. 6
  - c) Describe in detail the sequence of unit operations to obtain pure Penicillin. 8
- Q.3
  - a) Discuss the basis of separation in following techniques i) centrifugation ii) liquid-liquid extraction iii) ion exchange chromatography iv) protein precipitation. 8
  - b) Discuss the classification of bioproducts on the basis of i) application ii) chemical nature. Give suitable examples of each class. 8
  - c) How does application of bioproduct affect downstream processing? 4
- Q.4
  - a) Explain the chemical methods of a cell disintegration. 8
  - b) Describe construction and working of a rotary vacuum filter. 8
  - c) Discuss the important factors that affect sedimentation velocity. 4

### PART-B

- Q.5
  - a) Compare between the following techniques: i) solvent extraction ii) aqueous two phase extraction. 5
  - b) What do you understand by supercritical fluid? Draw a well labeled diagram of apparatus used for super critical phase extraction. What are the advantages of supercritical fluid extraction over solvent extraction? 10
  - c) Briefly explain and give mathematical expression for: i) Langmuir adsorption isotherm ii) Freundlich adsorption isotherm. 5
- Q.6
  - a) Explain the principle of separation in i) SDS-PAGE electrophoresis ii) Agarose gelelectrophoresis iii) Isoelectric focusing iv) Electrodialysis 10
  - b) What are cloning vectors? Give examples. 10
- Q.7 Write detailed notes on:
  - a) Crystallization.
  - b) Distillation. 10x2

End Semester Examination, Dec. 2016  
B. Tech.–Fifth Semester  
ANIMAL BIOTECHNOLOGY(BT-506 / BT-506A)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Answer briefly

- a) How animal cell culture is sterilized?
- b) What is the role of cryoprotectant DMSO or glycerol in cryopreservation?
- c) What are the limitations of Gene therapy?
- d) Differentiate between transfection and transformation.
- e) Explain mechanism of action of Ribozymes.
- f) What are the advantages of serum free media?
- g) What are the major cell culture contaminants?
- h) What do you understand by SCNT method?

2½x8

PART-A

Q.2 What are the causes of contamination in cell culture and how can one prevent contamination in it? 20

Q.3 a) What are the techniques employed for immortalization? 10  
b) What is the need of preservation of animal cell lines? Explain how one can maintain them. 10

Q.4 What is transfection? Describe the techniques of transgenic animal production in detail. 20

PART-B

Q.5 a) Describe the techniques for detection of genetic diseases in detail. 10  
b) What is Gene therapy? Explain its types and the need for it. 10

Q.6 Explain with examples:  
a) Oncogenes and antioncogenes. 10  
b) Cancer therapy. 10

Q.7 a) What are stem cells and their sources? 10  
b) Explain embryonic stem cells and their applications in detail. 10

# End Semester Examination, Dec. 2016

## B. Tech.–FifthSemester FOOD BIOTECHNOLOGY(BT-507)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Answer briefly

- a) Explain the term 'food microbiology'.
- b) Give two examples of microbes used in fermentation.
- c) What is meant by SCP?
- d) Name two spoilage organisms affecting fruits.
- e) What is meant by MPN?
- f) Differentiate between food additive and adulterant.
- g) How are radiations relevant to food industry?
- h) Which is the first microbe to be used as SCP?
- i) Name two enzymes that are important in cheese production.
- j) What is process waste?

2x10

### PART-A

- Q.2 a) Explain the types and behavior of various microorganisms in food. 10  
b) Give a synopsis of different genera of yeast common to food. 10
- Q.3 a) Give an account of various methods used for detection of microorganisms in food. 10  
b) Discuss about the spoilage of fresh and processed meat. Give examples for the type of microbes involved in the process. 10
- Q.4 What is meant by surface examination of food? Explain the various methods used to examine the food surface microbiologically. 20

### PART-B

- Q.5 a) Explain the role of temperature in food preservation with appropriate examples. 10  
b) Discuss about the role of different organisms in pickling. 10
- Q.6 a) Discuss the protocol for production of bread on industrial scale in detail. 10  
b) What are single cell proteins? What is their utility and how are they produced? 10
- Q.7 How food waste is utilized in production of valuables? Explain the present state and the problems being faced in its utilization. 20



End Semester Examination, Dec. 2016  
B. Tech. – Sixth Semester  
PLANT BIOTECHNOLOGY (BT-601)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Answer in brief:

- a) Mention the significance and uses of haploids.
  - b) What is the status of chromosome number in somatic hybrids?
  - c) What are post-translational modifications?
  - d) Describe the structure of a T-plasmid.
  - e) Mention the use of transgenics in improvement of shelf-life and storage of a plant product.
- 4 × 5

PART-A

- Q.2 a) Explain the process of micropropagation through shoot-tip culture. 10  
b) Enlist the advantages and disadvantages of micropropagation. 10
- Q.3 a) Describe various methods of protoplast isolation in detail. 10  
b) Mention any two methods for selection of somatic hybrids in cultures. 10
- Q.4 Write short notes on:  
a) Bio-control of pathogens. 10  
b) Bio-pesticides. 10

PART-B

- Q.5 a) Describe the Maxam-Gilbert method of gene sequencing. 12  
b) How is molecular tagging of genes useful for genetic improvement in plants? 8
- Q.6 a) Explain various methods of direct gene transfer in plants. 10  
b) Discuss the role of viruses as vectors. 10
- Q.7 Discuss the mechanisms that confer abiotic stress resistance to plants. 20

End Semester Examination, Dec. 2016  
B. Tech.(Biotechnology) – Sixth Semester  
ENVIRONMENTAL BIOTECHNOLOGY (BT-602)

Time: 3 hrs.

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

Q.1 Briefly answer:

- a) Differentiate between a point source and a non-point source.
- b) Give significance of sedimentation and equalization in wastewater.
- c) What are the factors affecting composting?
- d) What are the different ways in which water gets contaminated?
- e) What do you understand by biomethanation?

4 × 5

PART-A

- Q.2 a) What is air pollution? Discuss about its sources, effect and measurement in detail. 10  
b) Is ozone useful or harmful to us? Discuss the threats to its depletion in atmosphere in detail. 10
- Q.3 a) How ponds are useful in anaerobic treatment of wastewater? 10  
b) What is membrane bioreactor? Explain different types of membrane bioreactors. 10
- Q.4 a) Give some typical features of recalcitrant organic compounds. 10  
b) What are various types of hazardous waste? Give a schematic representation of the generation of waste, storage, collection, transportation, processing and final disposal. 10

PART-B

- Q.5 a) Discuss the use of bacteria and fungi in biodegradation of xenobiotic compounds. 10  
b) What are the factors affecting biodegradation? 10
- Q.6 a) Discuss the mechanism and types of phytoremediation. 10  
b) Enlist the advantages and disadvantages of biopiles. 10
- Q.7 Write short notes on:  
a) Biomining and bioleaching.  
b) Bioplastic and biopolymers. 10 × 2

End Semester Examination, Dec. 2016  
B. Tech. – Sixth Semester  
PHARMACEUTICAL TECHNOLOGY (BT-621A)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Answer briefly

- a) What type of drugs are considered 'misbranded' or 'adulterated' according to Drugs and cosmetics act of India? 4
- b) Differentiate between 'Pharmacokinetics' and 'Pharmacodynamics'. 3
- c) List any four types of pharmaceutical dosage forms. 2
- d) Name any two methods of size reduction. 2
- e) What are targeted drug delivery systems? 3
- f) What types of drugs are formulated as capsules? 3
- g) Give examples of sterile dosage forms. 3

PART-A

- Q.2 a) Define and classify dosage forms. Compare oral and systemic routes of drug delivery. 10
- b) Describe various steps for new drug development with the help of flowchart. 10
- Q.3 a) Discuss sequentially different types of unit operations required for the production of antibiotic tablets. 10
- b) Explain the technique of 'Percolation'. Discuss the process in detail. 10
- Q.4 a) Why do we need new drug delivery systems? Explain any 4 novel methods of drug delivery. 10
- b) Explain the concept of sustained drug delivery systems. What are the materials that allow sustained drug release? 10

PART-B

- Q.5 a) What are the different physiological barriers to the distribution of drug in the body? 8
- b) Explain receptor theory. 6
- c) Discuss different factors that affect bioavailability of the drugs. 6
- Q.6 a) Describe the various adjuvants required in the formulation of syrups. 6
- b) Explain giving suitable examples the reasons behind drug incompatibilities. 6
- c) Enlist various bases used for manufacture of ointments. Discuss preparation, packaging and labeling of ointments. 8
- Q.7 Describe in detail manufacture of injectible drugs. 20

# End Semester Examination, Dec. 2016

## B. Tech.–SixthSemester HUMAN GENOMICS (BT-621B)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Answer briefly:

- |  |   |
|--|---|
| a) Aims and objectives of HGP.                           | 4 |
| b) Differentiate between proto-oncogenes and onco genes. | 2 |
| c) PCR /OLA procedure.                                   | 3 |
| d) Advantages of DNA /RNA probes.                        | 3 |
| d) Karyotype analysis.                                   | 4 |
| e) Maternal-fetal incompatibility.                       | 4 |

### PART-A

- Q.2 a) Explain Mendel's laws of genetics with suitable examples. 10  
b) What are sex-linked traits and explain how they inherit in human with suitable examples? 10
- Q.3 What do you mean by disease gene versus susceptibility? Discuss diseases associated with X-chromosome. 20
- Q.4 a) Describe the medical procedure used in prenatal diagnosis of chromosomal abnormalities and fetal infection with its risk and advantages. 12  
b) Differentiate between karyotype and RFLP analysis. 8

### PART-B

- Q.5 Discuss general rules followed in autosomal recessive inheritance. How pedigree analysis is helpful in identification of a genetic disease? 20
- Q.6 Describe technique of DNA finger printing with its applications. 20
- Q.7 Enumerate the application of gene therapy in various disorders. How bone marrow transplantation in leukemia is done? 20

End Semester Examination, Dec. 2016  
B. Tech.– First/ Second Semester  
ELEMENTS OF ELECTRICAL ENGINEERING (EE-101B)

Time: 3 hrs.

Max Marks:100

No. of pages:1

Note: Attempt FIVE questions in all;Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

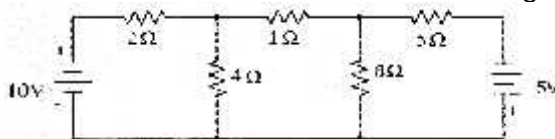
Q.1 Answer the following:

- a) Define 'form factor'.
- b) State Kirchhoff's Current law.
- c) What do you mean by capacitive reactance?
- d) Name the losses in a transformer?
- e) Write two advantages of permanent magnet moving coil instrument.
- f) Define 'power' and 'energy'.
- g) Under resonant condition the power factor of a series RLC circuit is \_\_\_\_\_.
- h) Define slip of an induction motor.
- i) Name the types of dc machines.
- j) What is a commutator in a dc machine?

2×10

PART-A

Q.2 a) Obtain the current in the  $1\Omega$  resistor of the circuit in figure using nodal analysis:



10

- b) State maximum power transfer theorem. Derive the condition for maximum power transfer and the maximum power transferred.

10

Q.3 a) An impedance of  $4 - j10 \Omega$  is connected in series with impedance  $6 + j8\Omega$ . The circuit is fed from 230 V, 50 Hz supply. Find the current and circuit impedance. Draw the neat phasor diagram of the circuit.

5

- b) Explain how an alternating voltage is generated.
- c) Differentiate between star and delta connected systems.
- d) Derive the expression for resonant frequency.

5

5

5

Q.4 a) Explain construction of moving iron voltmeter.

10

- b) Distinguish between induction type energy meter and wattmeter.

10

PART-B

Q.5 a) Derive the emf equation of a single-phase transformer.

10

- b) Explain open circuit and short circuit test for a single phase transformer.

10

Q.6 a) Draw the parts of a dc machine and briefly explain.

10

- b) Explain the working of a dc motor.

5

- c) State the applications of a dc shunt motor.

5

Q.7 a) Differentiate between slip ring and squirrel cage induction motor.

6

- b) Explain any two types of single phase induction motors.

14

End Semester Examination, Dec. 2016  
B. Tech.— First/ Second Semester  
ELEMENTS OF ELECTRICAL AND ELECTRONICS ENGINEERING  
(EE-102A)

Time: 3 hrs.

Max Marks: 100

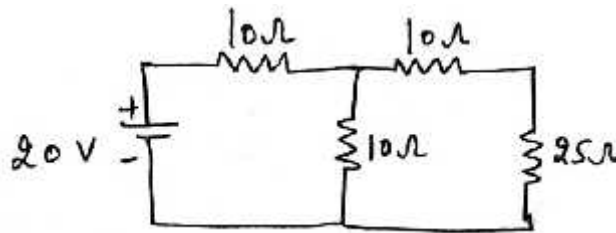
No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

- Q.1
- State KCL and KVL.
  - State superposition theorem with its application.
  - What is power factor? What is its significance?
  - What are the advantages of three phase supply over single phase?
  - Can three phase induction motor run at synchronous speed? Justify the statement.
  - Why schottky diode is called as hot carrier diode?
  - What are filter circuits? What is their requirement?
  - Among common base, common emitter and common collector, which configuration is most widely used and why?
  - Define bipolar and unipolar transistors with examples.
  - Why NAND and NOR gates are called as universal logic gates?
- 2×10

PART-A

- Q.2
- Use Thevenin theorem to find current through 25  $\Omega$  resistor.



12

- Explain delta to star and star to delta transformation and its significance.

8

- Q.3
- Write short notes on:
    - Series resonance.
    - Active and reactive power.
    - Power factor.
    - Average value, r.m.s value.
    - Form factor and peak factor.
  - Explain delta and star connection and derive the relation between line and phase quantities of star connection.
- 2×5  
10
- Q.4
- Differentiate between core and shell type transformers.
  - Explain construction and working principle of DC generators.
  - Explain the working principle of induction motor.
- 5  
8  
7

PART-B

- Q.5
- Explain various breakdown mechanisms occurring in P-N junction diode.
  - Explain working principle of:
    - Schottky diode.
    - Photo diode.With their applications.
- 5  
10

- c) What are clipping circuits? Explain with classification and applications. 5
- Q.6 a) Draw and explain common base configuration of transistor with input and output characteristics. 10
- b) Explain working principle of oscillator. 5
- c) Draw and explain working of  $n$  channel JFET. 5
- Q.7 a) Convert:
- $(A C E . B D F)_{16} = (?)_2$ .
  - $(1 2 3 4 5 6 7)_8 = (?)_2$ .
  - $(F E F . E F E)_{16} = (?)_8$ .
  - $(999)_{10} = (?)_2$
  - $(101 . 110)_2 = (?)_{10}$ .
  - $(999)_{10} = (?)_8$ . 1 × 6
- b) Prove that:
- $A + \overline{A}B = A + B$
  - $(A + B)(A + C) = A + BC$
  - $A + AB + ABC + ABCD = A$  2 × 3
- c) Draw and explain with truth table working of S-R flip-flop. 8

End Semester Examination, Dec. 2016  
B. Tech.— Third Semester  
NETWORK ANALYSIS AND SYNTHESIS (EE-301B)

Time: 3 hrs.

Max Marks: 100

No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

Q.1 a) Write the Laplace transformation of  $\frac{d^m f(t)}{dt^m}$ .

b) What is characteristic equation of a network?

c) Write the properties of a positive real function.

d) Write the properties of a RC network function.

e) What is short circuit admittance of two port network?

f) Define the 'expression of current in RC network with D.C. excitation'.

g) Define 'twig and link in graph theory'.

h) Determine the characteristic impedance of low pass T-network filter.

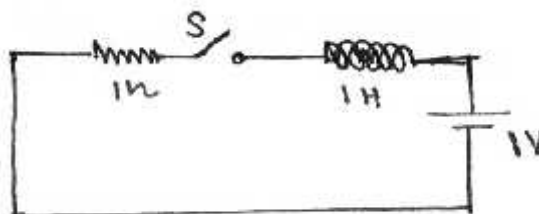
i) What is the application of hybrid parameters?

J) What are the condition of symmetry in terms of Y parameters?

2 × 10

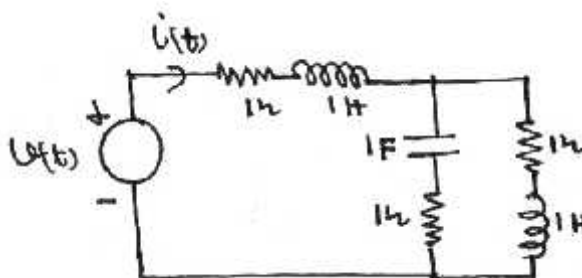
PART-A

Q.2 a) Find the current in RL network shown in figure when switch is closed at  $t = 0$ . (Assume initial current in L is zero).



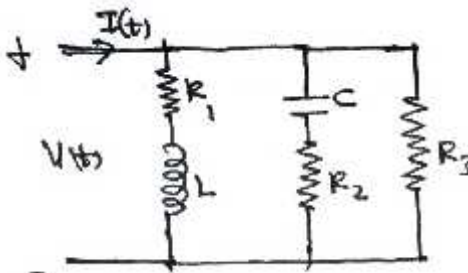
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b) Represent the given network in S-domain and calculate  $i(t)$ .



10

Q.3 a) Determine the driving point impedance of the network shown in the figure given below:



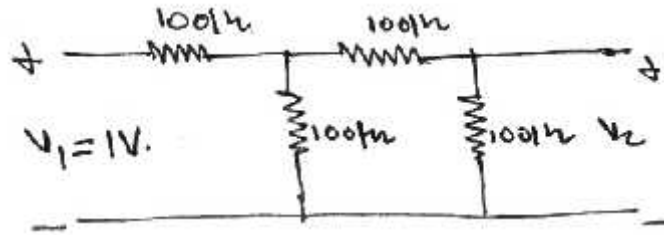
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b) Determine Y-parameters in terms of hybrid-parameters.

10



Q.4 a) Find voltage  $V_2$  in the network shown in the figure:



10

b) Write the restrictions of location of poles and zeros of driving point functions.

10

### PART-B

Q.5 a) Describe Foster-I and Foster-II form of realization of RC function. 10

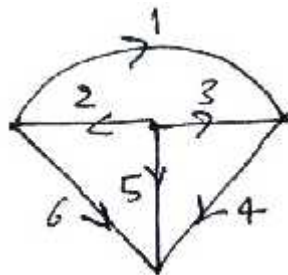
b) Synthesize the network using both Foster-I and II form whose transfer function impedance  $Z(S)$  is given,  $Z(S) = \frac{(S+4)(S+6)}{(S+5)(S+5)}$ . 10

Q.6 a) Describe the cut off frequency of high pass proto type  $f$  section filter. Give the working condition of high pass filter. 10

b) Design a constant  $K$  low pass  $f$  -section filter having cut off frequency 5 KHz and characteristics impedance  $Z_0 = 1K \text{ ohm}$ . Also determine the frequency at which filter offer attenuation of 50dB. 10

Q.7 a) Explain incidence matrix and tie-set matrix with the help of an example. 10

b) For the graph shown below, determine the cut-set matrix corresponding to the tree having twig 4, 5, 6 and 2, 3, 5.



10

End Semester Examination, Dec. 2016  
B. Tech.–Third Semester  
ELECTRICAL MACHINES-I (EE-302B/EE-302C)

Time: 3 hrs.

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

- Q.1
- Can transformers be operated at various frequencies?
  - How eddy current are reduced in transformer?
  - Define 'voltage regulation' of a transformer.
  - What is the need of instrument transformer?
  - Draw the phasor diagram and connection diagram of:
    - Dy6
    - Dy11
  - Write down energy balance equation for an electrical machine.
  - What is the function of a commutator?
  - Draw external characteristics curve for DC shunt motor.
  - In which motor stabilizing winding is used and why?
  - List advantages of regenerative braking.
- 2 × 10

PART-A

- Q.2
- Derive the emf equation of a transformer. 10
  - Draw the phasor diagram of 1- $\phi$  transformer for unity Pf, lagging Pf and leading Pf and explain the same. 10
- Q.3
- State and explain relationship between secondary phase voltage and current for  $\Delta$ -Y connection. 10
  - Explain briefly Scott connection for 3-phase to 2-phase transformation. 10
- Q.4
- What is co-energy? Derive the expression for force and torque in magnetic field system. 20

PART-B

- Q.5
- Explain the construction and working principle of dc machine. 10
  - Define commutation in dc machine and describe methods to improve it. 10
- Q.6
- Derive the torque equation for dc motor. 10
  - A dc shunt motor connected to 125 V dc supply line and is found to have a back emf of 90 V at 1200 rpm. Find the speed of this machine when it develops a torque of 30 Nm,  $R_a = 0.20 \Omega$ . 10
- Q.7
- What is regenerative braking? Explain the principle of regenerative braking of dc motor. 10
  - Write short notes on (any two):
    - Swinburne Test.
    - Brake Test.
    - Hopkinson Test.
- 5 × 2

End Semester Examination, Dec. 2016  
B. Tech. – Fourth Semester  
POWER SYSTEM-I (EE-304A)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Answer the following:

- a) Define 'base-load' and 'peak-load'.
- b) What do you mean by GMD?
- c) What is depreciation?
- d) Why grading of cables are done?
- e) What factors are taken into account while selecting the site for a steam power plant?
- f) The max demand on a power station is 100 MW. If annual load factor is 40%. Calculate the total energy generated in a year.
- g) What is skin effect?
- h) Why string efficiency of dc is 100%?
- i) What are desirable characteristics of tariff?
- j) Why suspension type insulators are preferred over pin type insulators? 2x10

PART-A

- Q.2 a) Draw a schematic diagram of hydro power plant and explain the function of each components in detail. 15  
b) Discuss the factors for choice of site for a nuclear power plant. 5
- Q.3 An electric supply company having a maximum load of  $50\text{ MW}$  generates  $18 \times 10^7$  units per annum and the supply consumers have an aggregate demand of  $75\text{ MW}$ . The annual expenses including capital cost are:  
For fuel = Rs. 90 lakhs.  
Fixed charges concerning generation = Rs. 28 lakhs.  
Fixed charges concerning transmission = Rs. 32 lakhs.  
Assuming 90% of the fuel cost is essential to running charges and the loss in transmission and distribution as 15% of KWh generated, deduce a two part tariff to find the actual cost of supply to the consumer. 20
- Q.4 a) Explain different types of insulators in details. 10  
b) What is sag? Derive an expression to calculate sag when supports are at equal levels. 10

PART-B

- Q.5 Derive an expression for the inductance per phase of a 3-phase line with:  
a) Equilateral spacing.  
b) Unsymmetrical spacing. 20
- Q.6 Explain different connection schemes of a distribution system in detail. 20
- Q.7 Write short notes on:  
a) Reactance grounding.  
b) Resistance grounding.  
c) Equipment grounding.  
d) Peterson coil grounding. 5x4

End Semester Examination, Dec. 2016  
B. Tech.— Third Semester  
MEASUREMENT AND INSTRUMENTATION (EE-306)

Time: 3 hrs.

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

- Q.1
- a) What is the difference between transducer and inverse transducer?
  - b) What are the various types of transducers which are used to measure temperature?
  - c) What do you mean by electrostatic focusing?
  - d) What is PLL?
  - e) What do you mean by signal conditioning?
  - f) What are lissajous patterns?
  - g) What are the types of sweeps?
  - h) What is the operation of current source in a pulse generator?
  - i) What type of electrodes are used in EEG?
  - j) Explain decode counting assembly. 2 × 10

PART-A

- Q.2
- a) Explain construction and working of LVDT. 10
  - b) What is strain gauge? Derive the expression for gauge factor of a strain gauge. 10
- Q.3
- a) Draw and explain the block diagram of ECG measurement. 10
  - b) Write a note on 'instrument amplifier'. 10
- Q.4
- Draw a neat block diagram of CRO and explain its functioning in detail. 20

PART-B

- Q.5
- a) Draw a block diagram of pulse generator and explain its working in detail. 10
  - b) Explain wave analyzer with its block diagram. 10
- Q.6
- a) What is data acquisition system? Draw and explain its block diagram in detail. 10
  - b) What are voltage controlled oscillator? 10
- Q.7
- a) Draw and explain the block diagram for frequency measurement in detail. 10
  - b) What are various types of digital voltmeters? Explain any one in detail. 10

End Semester Examination, Dec. 2016  
B. Tech.— Fourth Semester  
ELECTRICAL MACHINES II (EE-401A)

Time: 3 hrs.

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

- Q.1
- a) Which electrical machine has minimum air gap and why?
  - b) List the important conditions for parallel operations of three phase alternators.
  - c) What is torque (power) angle  $\delta$  ?
  - d) Explain synchronous condenser.
  - e) How many windings are there in the stator of 1-phase induction motor and how they are placed?
  - f) What happens to the terminal voltage of an alternator with increase in load?
  - g) Draw the short circuit characteristics of an alternator.
  - h) What is a universal motor?
  - i) List various types of permanent magnet brushless motors.
  - j) What are the disadvantages of induction generator? 2 × 10

PART-A

- Q.2
- a) Derive an expression for the torque developed in a three phase induction motor and find the condition for maximum torque. 15
  - b) Draw the circle diagram by labeling each term in it neatly. 5
- Q.3
- a) Why starters are necessary for starting of a 3-phase induction motors? List the different starting methods for the 3-phase induction motor and explain anyone with a neat sketch. 12
  - b) Explain the slip-power recovery control method of speed control of 3-phase induction motor. 8
- Q.4
- a) Describe in detail cross-field theory and draw the representative equivalent circuit diagram. 10
  - b) Explain principle and working of capacitor start single phase induction motor with circuit diagram. Also state its applications. 10

PART-B

- Q.5
- a) What do you mean by voltage regulation? List the various methods for determining voltage regulation and describe potier triangle method in detail. 10
  - b) Derive the emf equation of 3-phase alternator. 6
  - c) Explain the following terms:
    - i) Leakage reactance.
    - ii) Synchronous impedance. 2 × 2
- Q.6
- a) Derive the commonly used expression for power developed by a synchronous motor. 10
  - b) Why the three phase synchronous motor is not self-starting? Describe the arrangement to make it self-starting. 10
- Q.7
- a) Describe in detail the working principle and constructional features of permanent magnet brushless motors. 10
  - b) Write a note on: 'reluctance motors'. 10

End Semester Examination, Dec. 2016  
B. Tech.— Fourth Semester  
ELECTRONIC INSTRUMENTATION (EE-402B)

Time: 3 hrs.

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

- Q.1
- a) What do you mean by primary and secondary transducers?
  - b) What is LVDT?
  - c) Why do we sample the signal?
  - d) Explain decade counting assembly.
  - e) List the types of electrodes used for ECG measurement.
  - f) What is the need of time base generator in CRO?
  - g) What is the difference between 3 digit and  $3\frac{1}{2}$  digit digital meter?
  - h) What do you understand by aquadag coating?
  - i) Draw the diagram for PLL.
  - j) Give the classification of distortion.
- 2 × 10

PART-A

- Q.2
- a) Explain construction and working of piezoelectric transducer with the help of proper diagrams. 10
  - b) Describe the method for measurement of temperature using of thermistor and thermocouple. 10
- Q.3
- a) Write a note on 'instrumentation amplifier'. 10
  - b) Draw and explain block diagram of ECG measurement. 10
- Q.4
- a) How the frequency measurement can be done with the use of CRO? 6
  - b) Draw the block diagram of CRO and explain following:
    - i) Synchronization.
    - ii) Positioning controls.
    - iii) Vertical deflection system.
    - iv) Types of sweep.
- 3½ × 4

PART-B

- Q.5
- a) Explain spectrum analyzer with a block diagram. 8
  - b) Explain wave analyzer with the help of a suitable block diagram. 12
- Q.6
- a) What is analog multiplexing? Discuss its types in detail. 10
  - b) Explain DC signal conditioning with the help of a suitable block diagram. 10
- Q.7
- a) Discuss digital to analog conversion and explain binary weighted resistance digital to analog converter. 10
  - b) Write short notes on (ANY ONE):
    - i) Time period measurement.
    - ii) Frequency measurement.
- 10

End Semester Examination, Dec. 2016  
B. Tech.— Fifth Semester  
SWITCH GEAR AND PROTECTION (EE-403A)

Time: 3 hrs.

Max Marks: 100

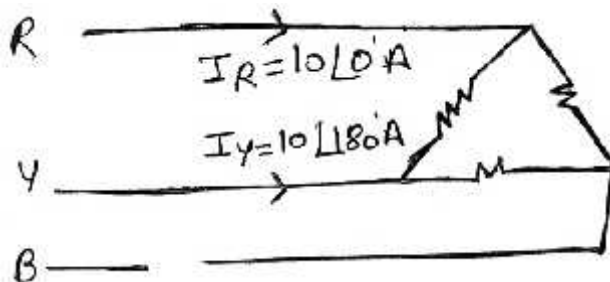
No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

- Q.1
- Explain the carrier current protection in relays.
  - What is neutral grounding?
  - The positive sequence current of a generator under L-L fault is 1 p.u. Find the negative and zero sequence current.
  - What are switching surges?
  - Define DC offset current.
  - What are different Zones of protection?
  - Give the expression for fault current when L-G faults occur.
  - On what factors resistance of a circuit breaker depends?
  - Which faults comes under unsymmetrical category?
  - What are advantages of oil circuit breaker?
- 2 × 10

PART-A

- Q.2
- One conductor of a 3-phase line is open. The current flowing to the  $\Delta$ -connected load through the line R is 10 A. With the current in line R as reference and assuming that line B is open, find the symmetrical components of line currents.



- 10
- Find the expression of fault current for L-L-G faults on alternator. 10
- Q.3
- How transients occur on transmission lines and synchronous machines? Explain in detail. 20
- Q.4
- Explain the construction and working of a vacuum circuit breaker with proper diagram. 10
  - Explain the various methods of arc extinction in circuit breaker. 10

PART-B

- Q.5
- Define following terms in relation to protective relay:
    - Current setting.
    - Plug setting multiplier.
    - Time setting multiplier.
    - Pick up value.2½ × 4
  - Explain static and digital microprocessor based relay in detail. 10
- Q.6
- Explain with the help of a neat diagram construction and working of non-directional induction type over-current relay. 10

b) Name and explain the relay used for protection of transformer.

10

Q.7 Write a short notes on (ANY TWO):

- a) Stator inter-turn protection of alternators.
- b) Lightning arrester.
- c) Lightning phenomena.

10×2



End Semester Examination, Dec. 2016  
B. Tech. – Fourth Semester  
PRINCIPLES OF COMMUNICATION (EE-404)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Answer the following:

- a) Define modulation. Discuss various types of modulation techniques.
- b) What are the functions of a transmitter in a communication system? Draw the block diagram of a transmitter.
- c) A transmitter radiates 10 kW with the carrier unmodulated and 11.5 kW when it is sinusoidally modulated. Calculate the modulation index. If another sine wave resulting in 50% modulation is transmitted simultaneously, calculate the total radiated power.
- d) Draw the block diagram of PLL and explain it.
- e) Given an angle modulated signal  $v(t) = 10 \cos[10^8 f t + 5 \sin 2f(10^3)t]$   
Determine the maximum frequency deviation and bandwidth.
- f) What is need of pre-emphasis and de-emphasis in FM?
- g) What is the need for sampling? What is Nyquist interval for the signal,  $x(t) = 5 \cos^2(1000f t)$ ?
- h) What is companding? How does it improve S/N ratio in PCM system?
- i) Explain differential PSK modulation scheme.
- j) Define noise temperature. How is it related to noise figure? 2x10

PART-A

- Q.2
  - a) Define signal. Explain different types of signals. Give examples of each. 10
  - b) Explain the working of a communication system with the help of a block diagram. 10
- Q.3
  - a) Explain synchronous demodulation method. Evaluate the effects of phase and frequency error in the local oscillator on synchronous DSB demodulation. 6
  - b) How is SSB signal generated by the filter method? Explain in detail with a block diagram and necessary equation. 6
  - c) Draw the block diagram of a super heterodyne receiver and explain its each block in brief. 8
- Q.4
  - a) What is the relation between phase modulation and frequency modulation? Explain how a FM wave can be generated using phase modulation. 6
  - b) What is the difference between NBFM and WBFM? Explain with a suitable block diagram the generation of WBFM starting from NBFM. 7
  - c) Explain how Foster Seeley discriminator is used for FM demodulation. 7

PART-B

- Q.5
  - a) What is the difference between PAM and PTM? Describe any two types of PTM techniques. 10
  - b) Explain differential pulse code modulation. What is the need for predictor? 10
- Q.6
  - a) Write a short note on 'QAM technique'. List its advantages and disadvantages in detail. 10
  - b) Define 'spread spectrum'. List the two spread spectrum techniques and explain any one of the them in detail. 10
- Q.7
  - a) Define 'noise'. Explain different types of interval noise in detail. 10

- b) Derive an expression for rms noise voltage at the output of passive RC low pass filter.

# End Semester Examination, Dec. 2016

B. Tech.— Fourth Semester

## POWER SYSTEM ENGINEERING (EE-406)

Time: 3 hrs.

Max Marks: 100

No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

- Q.1
- a) Explain the purpose of surge tank in hydro-electric power plant.
  - b) What factors are taken into account while selecting the site for a nuclear power plant?
  - c) Explain depreciation?
  - d) The maximum demand on a power station is 100 MW. If the annual load factor is 40%, calculate the total energy generated in a year.
  - e) What are the components for construction of overhead transmission line?
  - f) Define 'corona effect'.
  - g) What is the necessity of system grounding in a power system?
  - h) What are bundled conductors? Discuss its advantages when used for overhead lines.
  - i) How does skin effect vary with conductor material?
  - j) What is Kelvin's law?
- 2 × 10

### PART-A

- Q.2
- a) Draw a schematic diagram of a steam power plant and explain its operation in detail. 10
  - b) Give the comparison of steam power plant, hydro-electric, diesel and nuclear power plant on the basis of initial cost, running cost, overall efficiency, space requirement and stand-by loss. 10
- Q.3
- a) Estimate the generating cost per Kwh delivered from a generating station from the following data:  
Plant capacity = 50 MW, Annual load factor = 40%, Capital cost = 1.2 crores, Annual cost of wages, taxation etc. = Rs. 4 lakhs, Cost of fuel, lubricating and maintenance etc. = 1.0 paisa/Kwh generated, Interest 5% per annum, depreciation 6% per annum of initial cost. 10
  - b) Define the following terms:
    - i) Demand factor.
    - ii) Diversity factor.
    - iii) Max demand.
    - iv) Load factor.
    - v) Plant capacity.2 × 5
- Q.4
- a) Deduce an approximate expression for sag when:
    - i) Supports are at equal level.
    - ii) Supports are not at unequal level.5 × 2
  - b) What is string efficiency? Explain various methods for improving string efficiency. 10

### PART-B

- Q.5 Derive an expression for flux linkages due to:

- a) Internal flux.
- b) External flux. 10×2

- Q.6
- a) Discuss different connection schemes of a distribution system. 10
  - b) A 2-wire DC distributor cable AB is 2 km long and supplies loads of 100 A, 150A, 200A and 50A situated 500 m, 1000 m, 1600 m and 2000 m from feeding point A. Each conductor has a resistance of 0.01  $\Omega$  per 1000 m. Calculate the p.d at each load point if a potential difference (p.d) of 300 V is maintained at point A. 10

- Q.7 Write short notes on:
- a) Solid grounding.
  - b) Reactance grounding.
  - c) Peterson coil.
  - d) Resistance grounding. 5×4

End Semester Examination, Dec. 2016  
B. Tech. – Fifth / Sixth Semester  
CONTROL SYSTEM ENGINEERING (EE-501A)

Time: 3 hrs

Max Marks: 100

No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

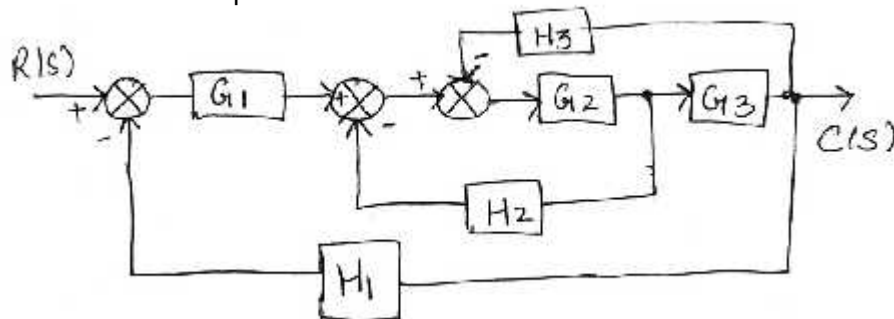
Q.1 Answer the following:

- Define 'transfer function'.
- Compare linear and non linear systems.
- What is gain margin?
- Define settling time of second order system.
- What do you mean by type-1 system?
- What is BIBO stability?
- What do you mean by break-away-point in root locus analysis?
- What are synchros?
- Draw the polar plot of transfer function  $K / (1 + ST_1)$ .
- Define states of the system.

10×2

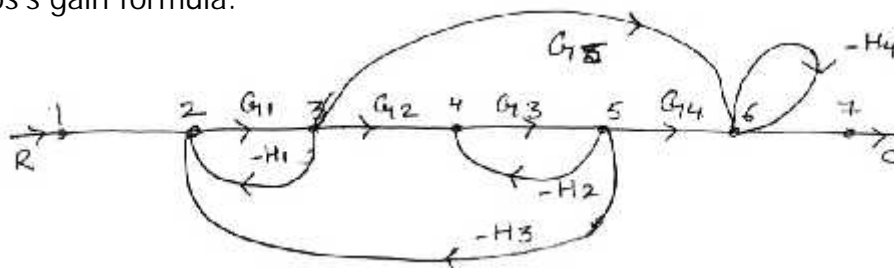
PART-A

- Q.2 a) Determine the transfer function  $(C(S)/R(S))$  of the given block diagram using block diagram reduction technique.



10

- b) Obtain the overall transfer function  $C/R$  of the signal flow graph given below using Maros's gain formula.



10

- Q.3 a) Discuss the time response of underdamped second order system with unit step input.
- b) The open loop transfer function of a unity feedback system is given by:

$$G(s) = \frac{108}{s^2(s+4)(s^2+3s+12)}$$

Find the static error coefficient and steady state error when subjected to the input given by  $r(t) = 2 + 5t + 2t^2$

10

- Q.4 Sketch the root locus as  $s$  varies from zero to infinity whose open loop transfer function is given as:

$$G(s)H(s) = \frac{K}{s(s+2)(s^2+6s+25)}.$$

20

### PART-B

- Q.5 a) Sketch the Bode Plot for the transfer function:

$$G(s) = \frac{1000}{s(1+0.1s)(1+0.0001s)}$$
 and investigate for stability.

10

- b) Sketch the Nyquist plot for the open loop transfer function:

$$G(s)H(s) = \frac{10}{(s+2)(s+4)}.$$

Determine the stability of closed loop control system by Nyquist criterion.

10

- Q.6 Write short notes on (any two):

- a) Magnetic amplifiers.
- b) Stepper motor and its applications.
- c) Servomotors.

10×2

- Q.7 a) Discuss a lead compensator using an electrical network. Also draw its Bode plot. 10  
b) How will you represent a system in state space analysis? Explain with an example. 10

End Semester Examination, Dec. 2016  
B. Tech.—Fourth / Fifth Semester  
POWER ELECTRONICS (EE-502A / EE-502B)

Time: 3 hrs.

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

Q.1 Briefly answer:

- a) Define 'holding current'.
- b) What are the applications of power electronics?
- c) What is the need of commutation?
- d) Explain string efficiency.
- e) What are circulating current?
- f) What is the basic principle of inverter?
- g) What is duty cycle?
- h) Define extinction angle.
- i) List the applications of cycloconverter.
- j) What is snubber circuit?

2 × 10

PART-A

- Q.2 a) Explain construction detail and working of MOSFET. Also enumerate its applications. 10
- b) Explain types of power diodes. 10
- Q.3 a) What do you mean by commutation? What are the various types of commutations? Describe any one commutation technique in detail. 12
- b) S.C.R with voltage rating of 1000 V and current rating of 200 A are available to be used in string to handle 6 KV and 1 KA. Calculate number of series and parallel units required if deviating factor is 0.6. 8
- Q.4 a) Explain the working of single phase full wave converter with RLE load. Draw the waveforms of load voltage and load current. 10
- b) Explain the working of a single phase dual converter. 10

PART-B

- Q.5 a) Discuss the working of single phase 180° mode bridge inverter with appropriate voltage waveform. 15
- b) Compare VS I and CS I. 5
- Q.6 a) Explain the working of type E chopper. 10
- b) A step up chopper has input voltage of 220 V and output voltage of 660 V. If the conducting time of chopper is 100  $\mu$ s. Compute:
- i) Pulse width of output voltage.
  - ii) In case output voltage is halved for constant frequency operation. Find average value of new output voltage. 10
- Q.7 a) What is cycloconverter? Explain its working with suitable diagram and waveform. Also enumerate its applications. 10

- b) Explain the working of a single phase voltage controller. Draw the suitable waveform of load voltage and load current.



End Semester Examination, Dec. 2016  
B. Tech.–Fifth Semester  
ELECTRICAL MACHINE DESIGN (EE-503)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Answer in brief:

- a) What is the significance of specific magnetic loading in the design of electrical machines?
- b) Define 'output coefficient of machine design'.
- c) Why should rotor slots never be made equal to stator slots?
- d) List down different methods of cooling of a transformer.
- e) What do you understand by fringing of flux?
- f) What is the significance of computer aided design of electrical machines?
- g) Differentiate between 'lap winding' and 'wave winding'.
- h) Define short circuit ratio of a synchronous machine.
- i) What do you understand by dispersion coefficient?
- j) Define 'window space factor'.

2x10

PART-A

- Q.2 a) Name and explain methods for measurement of temperature rise in electrical machines. 6
- b) Derive an expression of temperature rise of an electrical machine with time. Also define the terms heating time constant and cooling time constant, indicating each on the temperature rise curve. 14
- Q.3 a) Calculate core and window areas required for a 1000 kVA, 6600/400 V, 50 Hz single phase core type transformer. Assume  $B_{\max} = 1.25 \text{ Wb/m}^2$  and current density of  $2.5 \text{ A/mm}^2$ . Voltage per turn is 30 volts and window space factor = 0.32. 15
- b) Why is stepped core preferred over square core of transformers? 5
- Q.4 a) Derive an expression for total mmf in a magnetic circuit of an electrical machine. 10
- b) Deduce expression for real and apparent flux density. 10

PART-B

- Q.5 a) Derive an expression for output equation of a DC machine. 10
- b) Discuss various cooling and ventilation methods for alternators. 10
- Q.6 a) Derive an expression for field design of turbo-alternators. 10
- b) Write short notes on:
- i) Damper windings.
  - ii) Stator winding of turbo-alternators.
- 5x2
- Q.7 a) What do you understand by computer aided design of electrical machines? Explain various methods of machine designing in detail. 15
- b) Explain design of rotor bars and slots in an induction motor. 5

# End Semester Examination, Dec. 2016

B. Tech.— Fifth Semester

## POWER SYSTEM PROTECTION (EE-506)

Time: 3 hrs.

Max Marks: 100

No. of pages: 1

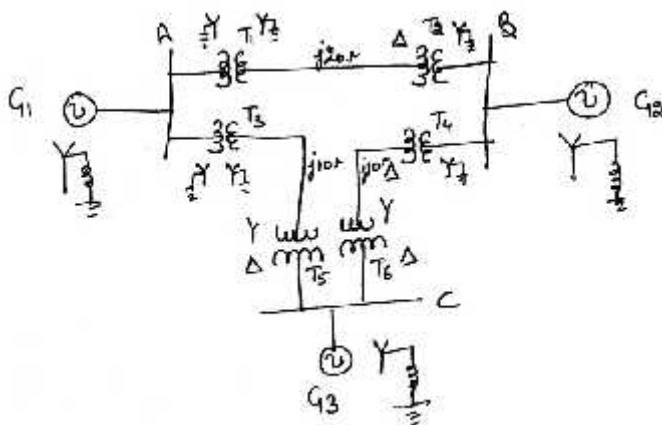
Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

- Q.1
- Why is it necessary to calculate short circuit current of an electrical system to be protected?
  - What is meant by percentage reactance?
  - Compare SLG fault and 3-phase fault from point of view of severity.
  - Why is current interruption easier in an AC circuit than in DC circuit?
  - What is importance of backup protection?
  - Define 'reach'.
  - What are essential elements of a relay?
  - Why  $SF_6$  gas is preferred for high voltage rating?
  - List the reasons for generation of overvoltages.
  - What is RRRV?

2×10

### PART-A

- Q.2
- Explain transients on a transmission line using a lumped R-L series circuit. 10
  - Explain phase shift in star-delta transformers. 10
- Q.3 Find the fault current for a L-G fault at "C" in the system shown in the figure. The rating of different equipment are:
- $G_1, G_2$ : 40MVA, 13.2KV,  $X'' = 0.15 pu$ ,  $X_2 = 0.15 pu$ ,  $X_0 = .08 pu$  .
- $G_3$ : 40MVA, 13.8KV,  $X'' = 0.20 pu$ ,  $X_2 = 0.20 pu$ ,  $X_0 = .08 pu$  .
- $T_1, T_2, T_3, T_4$ : 40MVA, 13.8/138KV,  $X_1 = X_2 = 0.10 pu$ ,  $X_0 = 0.08 pu$  .
- $T_5, T_6$ : 30MVA, 13.8/138KV,  $X_1 = X_2 = 0.10 pu$ ,  $X_0 = 0.08 pu$



20

- Q.4
- Describe the construction, operating principle and application of  $SF_6$  circuit breaker with a neat sketch. Also discuss its advantages over other type of circuit breaker. 15
  - Explain any one theory of arc interruption. 5

### PART-B

- Q.5 Explain construction and working of induction type relays (cup type and disc type). 20
- Q.6
- Describe a directional over current relay. Explain where and why one would prefer directional current relay. 15
  - Distinguish between O.C relay, directional relay and differential relay. 5
- Q.7
- Describe the construction and working of surge arrestor. 10
  - Explain various methods to control switching surge overvoltages. 10

End Semester Examination, Dec. 2016  
B. Tech – Sixth Semester  
ELECTRICAL DRIVES (EE-602)

Time: 3 hrs.

Max Marks: 100

No. of pages: 1

Note: Attempt ANYFIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

- Q.1
- What is the selection criteria of a drive system?
  - Draw speed torque characteristics curve of a hoist drive.
  - What is frequency control using cycloconverter?
  - Draw speed-torque characteristics of a DC separately excited motor.
  - What is the effect of change in terminal voltage on the speed of a DC motor?
  - Write an expression for output voltage in case of step-up-chopper.
  - What is meant by reverse voltage braking?
  - Why  $V/f$  is maintained constant for speed below base speed?
  - What is the difference between static Scherbius and static Kramer drive?
  - What are various methods used for speed control of synchronous motor? 2 × 10

PART-A

- Q.2
- Draw the block diagram of electric drive. Explain the functions of each component of electric drive in detail. 10
  - What is the difference between static and dynamic stability? 5
  - Explain steady state stability of a motor load system. 5
- Q.3
- How can the frequency be decreased using a cycloconverter explain? 10
  - Describe the working of single phase to single phase step down cycloconverter for continuous conduction for bridge type cycloconverter. 10
- Q.4
- A 220V, 1500rpm, 10A separately excited DC motor is fed from single phase fully controlled rectifier with an AC source voltage of 230V, 50Hz,  $R_a = 2\Omega$ . Conduction can be assumed to be continuous. Calculate firing angle for:
    - Half the rated motor torque and 500rpm.
    - Rated motor torque and (-1000rpm). 12
  - Explain converter based speed control of a DC motor. 8

PART-B

- Q.5
- Explain how the speed of a DC series motor is controlled with the help of a chopper. 10
  - A 230 V, 960 rpm and 200 A separately excited DC motor has an armature resistance 0.02  $\Omega$ . The motor is fed from a chopper which provides both motoring and braking operations. The source has a voltage of 230 V. Assuming continuous conduction, calculate duty ratio of chopper for motor operation at rated torque and 350 rpm. 10
- Q.6
- Explain the speed control of an induction motor using current source inverter. 10
  - Explain the variable frequency control of an induction motor in detail. 10
- Q.7
- Explain speed control of an induction motor using static Kramer drive. 10
  - What is variable frequency control of a synchronous motor? 10

End Semester Examination, Dec. 2016  
B. Tech. – Sixth Semester  
POWER SYSTEM-II (EE-603A)

Time: 3 hrs

Max Marks: 100

No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Answer briefly:

- Draw phasor representation of a 3-w alternator.
- Differentiate between augmented incidence matrix and incidence matrix.
- Why is Newton Raphson method preferred over Gauss Seidal method?
- What do you understand by slack bus and generator bus?
- What is transient and dynamic stability?
- Define AVR.
- What is the function of tie line in a power system network?
- What are the assumptions commonly considered in stability studies?
- What are the various FACT controllers?
- Name various techniques that are used to solve load flow problem.

2×10

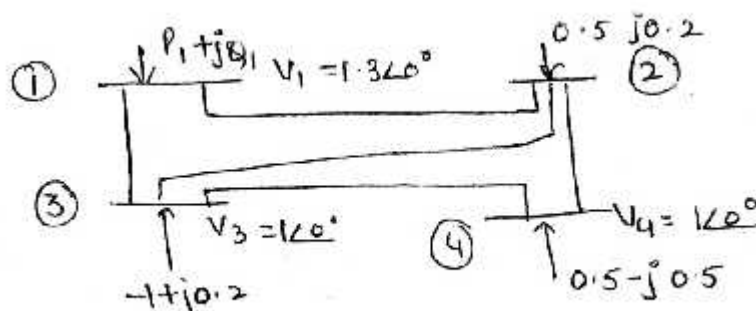
PART-A

- Q.2 a) Explain with mathematical equations representation of transmission line and synchronous machine. 12
- b) Two generators are connected in parallel to 6.6 kV bus. One of the generators has rating 20 MVA and reactance 15% while second generator is rated at 15 MVA and reactance of 12%. Calculate p.u. reactance on 50 MVA and 6.6 kV base. 8
- Q.3 a) Derive the expression for formulation of network matrices:  
 $Y_{BUS} = A'YA$  10
- b) Draw the  $Y_{BUS}$  for the given data of the power system network:

Element	Bus number		Primitive impedance
	From	To	
1	1	0	0.08
2	2	0	0.10
3	1	2	0.5
4	1	3	0.4
5	1	4	0.25
6	3	4	0.20
7	2	4	0.25

10

- Q.4 a) Write a flowchart to explain Newton Raphson method for load flow study. 10
- b) The following figure shows four bus networks:



$$Y_{BUS} = \begin{bmatrix} 5-j9 & -2+j4 & -1+j6 & 0 \\ -2+j6 & 3.67-j11 & -0.67+j2 & -1+j3 \\ -1+j3 & -0.67+j2 & 3.7-j11 & -2+j6 \\ 0 & -1+j3 & -2+j6 & 3-j9 \end{bmatrix}$$

Determine the value  $V_2$  after first iteration, using Gauss Seidal method.

10

### PART-B

- Q.5 Why is load frequency control important in operation of power systems? Describe the various components of automatic generation control with a block diagram. 20
- Q.6 a) Explain how can stability be determined using equal area criteria. 14  
b) Explain the factors affecting the transient stability. 6
- Q.7 a) Explain power quality issues and challenges and how to improve the power quality. 7  
b) What are FACTS devices? Explain the types of FACTS. 13

End Semester Examination, Dec. 2016  
B. Tech. – Sixth Semester  
DESIGN OF ELECTRICAL MACHINES (EE-604)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Briefly answer:

- a) What are the various modes of heat transfer from the inner most part of machine to the surroundings?
- b) Define specific electrical and magnetic loading.
- c) What is leakage flux?
- d) What are the types of ventilation?
- e) What is the advantage of using stepped core in transformers?
- f) Why are current densities in primary and secondary windings of transformer taken equal?
- g) Define Carter's gap coefficient.
- h) Distinguish between lap and wave winding.
- i) What do you mean by runaway speed?
- j) What type of rotor windings are preferred for small induction motors? 2×10

PART-A

- Q.2 a) Explain the term: 'heating time constant' and show it has small value for a well-ventilated machine and large value for a poorly ventilated machine. 10
- b) Briefly explain different thermal duties types of electrical machines. 10
- Q.3 a) Derive the output equation of 3-w shell type transformer. 10
- b) Calculate the core and window area required for a 1000 kVA, 6600/400 V, 50 Hz single phase core type transformer. Assume a maximum flux density of  $1.25 \text{ wb/m}^2$  and current density of  $2.5 \text{ A/mm}^2$ . Voltage per turn = 30 V and window space factor is 0.32. 10
- Q.4 a) Derive an expression for m.m.f of air gap of a magnetic circuit. 15
- b) Name and explain various methods employed for calculation of m.m.f for a tapered teeth. 5

PART-B

- Q.5 a) What is the significance of specific loading in the design of a d.c. machine? And also derive the output equation of a d.c. machine. 10
- b) Calculate diameter and length of armature of a 7.5 kW, 4 pole, 1000 rpm, 220 V shunt motor. Given full load efficiency ( $\eta$ ) = 0.83, maximum gap flux density is  $0.9 \text{ wb/m}^2$ , specific electric loading = 30,000 A/m,  $k_f = 0.7$ , assuming maximum efficiency occurs at full load and field current is 25% of rated current and pole face is square. 10
- Q.6 a) Explain with mathematical equations the design of field winding for synchronous machines. 12
- b) Discuss the various ventilation and cooling methods of alternators. 8

- Q.7    a) Derive an expression for current in end rings and area of end rings for a squirrel cage induction motor. 15
- b) On what factors does choice of number of stator slots depend in an induction motor? 5

End Semester Examination, Dec. 2016  
B. Tech.— Sixth Semester  
HIGH VOLTAGE ENGINEERING (EE-621A)

Time: 3 hrs.

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

- Q.1
- a) Draw the standard impulse wave shape.
  - b) What are biological aspects in EHV?
  - c) What is surge impulse level?
  - d) How principle of resonance is used to produce high voltages?
  - e) Draw the voltage–ampere characteristics of surge arrester. Also write down its equation.
  - f) State the principle of electrostatic machines.
  - g) Name any two devices used for protection against lightning over voltages.
  - h) What is partial discharge?
  - i) What is the purpose of insulation coordination?
  - j) State Paschen's law?
- 2×10

PART-A

- Q.2
- a) Explain the working of VandeGraff generator with a proper diagram. 10
  - b) What is the basic principle for a voltage multiplier circuit? 2
  - c) Derive an expression for ripple in cascaded multiplier circuit. 8
- Q.3
- a) Explain the working principle of a resonant transformer. How it is different from a power transformer? 10
  - b) Give and explain Marx circuit arrangement for multistage impulse generators. 10
- Q.4
- a) Discuss the mechanism of lightning discharge. 10
  - b) Write short notes on:
    - i) Measures taken to control overvoltages.
    - ii) Expulsion type lightning-arrestors. 5×2

PART-B

- Q.5
- What is meant by insulation co-ordination? How are the protective devices chosen for optimal insulation level in a power system? 20
- Q.6
- a) Derive Townsend's current growth equation and explain Townsend's criterion for breakdown. 10
  - b) Explain Suspended Particle theory for breakdown in liquids. 10
- Q.7
- a) Explain maintenance and diagnostic testing for bushing. 15
  - b) Explain the principle of live line maintenance in brief. 5



End Semester Examination, Dec. 2016  
B. Tech.— Seventh Semester  
COMPUTER APPLICATIONS IN POWER SYSTEMS (EE-622)

Time: 3 hrs.

Max Marks: 100

No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

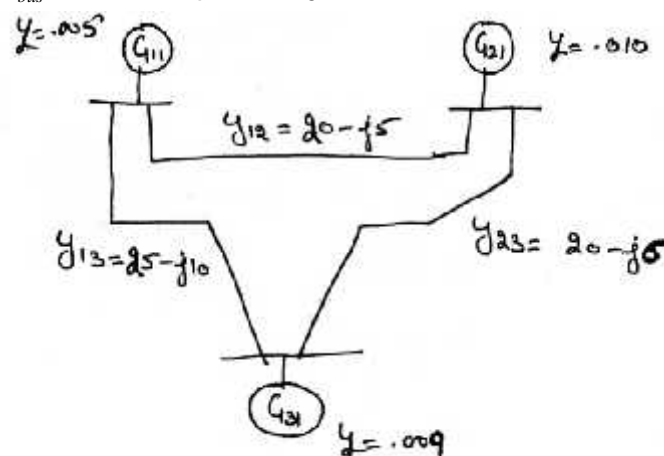
Q.1 Answer the following:

- a) What are major concerns of power system design and operation?
- b) What are the method available for forming the bus admittance matrix?
- c) What is sequence operator?
- d) List the various types of faults.
- e) Give two advantages and disadvantages of Newton Raphson method.
- f) Define unit commitment.
- g) What are security constraint for economic dispatch?
- h) List advantages of per unit system.
- i) What is area control error?
- j) Define contingency.

2 × 10

PART-A

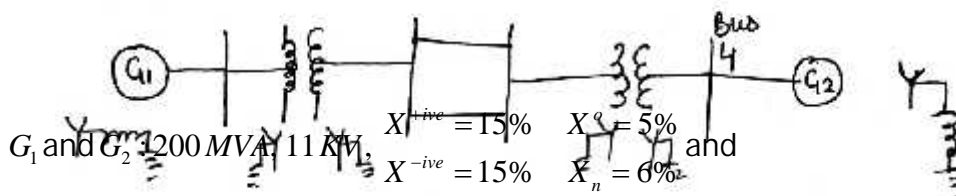
- Q.2
  - a) What do you understand by AGC (Automatic generation control). Explain in detail. 10
  - b) Discuss power quality issues of challenges. 10
- Q.3
  - a) Draw and explain equivalent circuit of synchronous motor, generator, transformer and transmission line during fault condition. 10
  - b) What are the symmetrical components? Obtain the balanced current if  $I_a = 1.5(30^\circ)$ ,  $I_b = 1(160^\circ)$ ,  $I_c = 1.2(130^\circ)$ . 10
- Q.4
  - a) Explain  $Z_{bus}$  algorithm using step-by-step method. 10
  - b) Determine  $Y_{bus}$  matrix of power system network.



10

PART-B

- Q.5 a) Determine the fault current and MVA at faulted bus for a line to ground fault at bus 4.



$T_1$  and  $T_2$  : 200 MVA, 11 / 220 KV,  $X_{leakage} = 9\%$ ,

$L_1$  and  $L_2$  :,  $X^{+ive} = X^{-ive} = 10\%$ ,  $X^o = 10\%$  on a base 100 MVA. Consider a fault at "a" phase. 10

b) Explain line-to-line fault. Derive an expression for it. 10

Q.6 a) Write the flow chart for Newton Raphson method. 10

b) The per unit admittance are indicated at the diagram and the bus data is given in Table. Determine the voltage at bus 2 and bus 3 after the first iteration using Gauss Seidal method.  $r = 1.6$ .

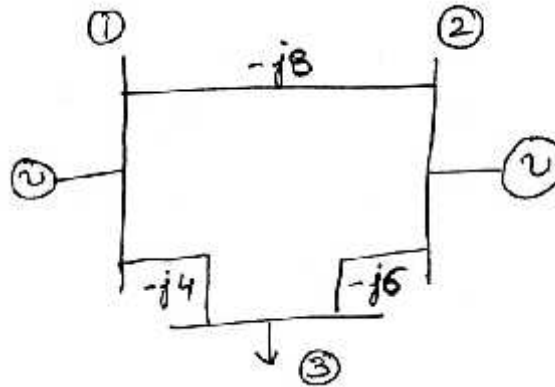


Table 2.1:

Bus No.	Bus data	Generater P.U		Load P.U		Bus voltage	
	Bus type	$P_G$	$Q_G$	$P_D$	$Q_D$	V	u
1	Slack	-				1.02	
2	PQ	0.05	0.15	0.5	0.15	-	
3	PQ	0	0	0.6	0.8	-	

10

Q.7 a) Explain and derive transmission loss formula for transmission without and with losses. 10

b) The operating characteristics of three plants with total capacity of 700 MW are given as:

$$F_1 = 0.8P_1^2 + 30P_1 + 100 \quad 50 \leq P_1 \leq 250$$

$$F_2 = 0.1P_2^2 + 32P_2 + 125 \quad 50 \leq P_2 \leq 250$$

$$F_3 = 0.12P_3^2 + 30P_3 + 150 \quad 50 \leq P_3 \leq 200$$

Find the load on each plant for total load of 650 MW.

10

End Semester Examination, Dec. 2016  
B. Tech.— Sixth Semester  
NEW AND RENEWABLE ENERGY RESOURCES (EE-625)

Time: 3 hrs.

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

- Q.1
- a) Explain the concept of 'Global warming'.
  - b) What are the main components of a flat plate collector and also give its applications?
  - c) What is photovoltaic cell and how it works?
  - d) Derive an expression for power developed due to wind.
  - e) Define the term: 'solidity with reference to wind energy'.
  - f) What are the limitations of tidal power generation?
  - g) Explain the process of pyrolysis.
  - h) What do you mean by 'mini and small hydro projects'?
  - i) What do you mean by 'energy farming'?
  - j) What is nuclear fusion? How does it differ from nuclear fission? 2×10

PART-A

- Q.2
- a) Discuss the following:
    - i) Greenhouse effect. 5×2
    - ii) Solar cooling. 5
  - b) How is the performance of concentrating collector evaluated? 5
  - c) Discuss various conventional sources of energy production in brief. 5
- Q.3
- a) Explain different types of photovoltaic systems with proper diagram. 10
  - b) Write short notes on:
    - i) Maximum power point tracker.
    - ii) VI characteristics of PV module. 5×2
- Q.4
- a) Give classification of wind turbines on the basis of axis of rotation. 10
  - b) Draw power duration and velocity duration characteristics of wind and also define the terminology used in this. 10

PART-B

- Q.5
- a) Discuss closed cycle and open cycle OTEC plant in detail. 10
  - b) How do you define tidal power plants on the basis of basins? 10
- Q.6
- a) How biomass conversion takes place? 6
  - b) What is anaerobic digestion? Explain briefly along with its benefits. 6
  - c) Explain the construction and working of different types of turbines used in small hydro power plants. 8
- Q.7
- a) Explain the working principle and operation of fuel cell with a neat diagram. 10
  - b) Write short notes on:
    - i) Power from nuclear fusion.
    - ii) Power from satellite stations. 5×2

End Semester Examination, Dec. 2016  
B. Tech. – Sixth / Seventh Semester  
ENERGY CONSERVATION AND MANAGEMENT (EE-626)

Time: 3 hrs

Max Marks: 100

No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Answer the following in brief:

- a) Define the term: 'energy audit'.
- b) List down the objectives of supply side management.
- c) What is the need for energy conservation?
- d) Explain the terms 'maximum demand and diversity factor'.
- e) Explain in brief DEFENDUS strategy.
- f) Define coefficient of performance.
- g) What do you understand by compensator in heating?
- h) Differentiate between base load and peak load.
- i) What is least cost power planning?
- j) Explain the instruments water flow meter and infrared thermometer. 2×10

PART-A

- Q.2 a) Explain the terms: i) Energy intensity. 6  
ii) Energy management. 6  
b) Draw and explain the organization chart for both non energy and energy intensive organization. 14
- Q.3 a) Discuss the types and significance of energy audit in detail. 8  
b) During the course of energy audit, the data collected regarding the consumption of LPG and electricity is as follows:  
i) Average consumption of LPG cylinders per month = 25  
ii) Power consumption of boiler = 3 kW  
iii) Power consumption of geysers = 10 kW  
Average running hours of boilers and geysers is 10 hrs/day.  
Number of months for the above consumption is 9 months. It is proposed by energy auditors to replace the same with solar water heaters. 100 liters of solar water heater can save 1000 kWh of electricity per year as well as 200 kgs LPG per year.  
I) Estimate LPG consumption in kg.  
II) Estimate number of 100 liters capacity solar water systems to replace LPG cylinders, geysers and boilers.  
III) Evaluate monetary savings and payback period. Assume cost of each solar water heater Rs. 20,000/- and cost of electricity is Rs. 8/ kWh. Take each cylinder containing 14 kgs of LPG to cost about Rs. 350/-. 12
- Q.4 a) Discuss the laws of thermodynamics in detail. 10  
b) Discuss refrigeration in detail with the help of a block diagram. 10

PART-B

- Q.5 a) What do you understand by load factor and diversity factor? Explain in detail. 10  
b) How is energy management related to electric drives? 10
- Q.6 a) What do you mean by life cycle costing? Discuss the various factors to be considered for life cycle costing. 11

- b) Explain the terms:
- i) Average rate of return.
  - ii) Internal rate of return.
  - iii) Present value method.

3 × 3

- Q.7 a) Write a short note on cogeneration technologies.  
b) Discuss in detail the types of cogeneration cycles.

6

14

End Semester Examination, Dec. 2016  
B. Tech. – Sixth / Seventh Semester  
ENERGY CONSERVATION AND MANAGEMENT (EE-626)

Time: 3 hrs

Max Marks: 100

No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

- Q.1
- List down objectives of supply side management.
  - Define the term: 'energy efficiency'.
  - What do you mean by compensator in heating?
  - Name different modes of heat transfer.
  - Give a few examples of topping cycle of cogeneration plant.
  - Explain the instruments: infrared thermometer and Fyrite.
  - What do you understand by the term: 'entropy'?
  - Define 'energy audit'.
  - What is least cost power planning?
  - Define the term: "coefficient of performance".
- 2 × 10

PART-A

- Q.2
- Explain the steps of energy management in detail. 12
  - Explain the concept of establishing energy database. 4
  - Define the term: 'energy intensity'. 4
- Q.3
- Discuss the types and significance of energy audit in detail. 7
  - During the course of energy audit, the data collection regarding the consumption of LPG and electricity is as follows:
    - Average consumption of LPG cylinders/month = 25.
    - Power consumption of geysers for bathing = 5 kW.
    - Power consumption of geysers for washing = 6 kW.
    - Power consumption of boiler for pantry = 4 kW.Average running hours of boilers and geysers = 8 hrs/day, number of months for the above consumption is 9 months. It is proposed by the energy auditors to replace the above with solar water heaters. 100 liters of solar water heater can save 1000 kWh of electricity per year. 100 litres of solar water heater can save 200 kg of LPG per year.
    - Estimate LPG consumption in kgs.
    - Estimate number of 100 litre capacity solar water systems to replace the LPG cylinders, geysers and boilers.
    - Evaluate monetary savings and payback period. Assume cost of each solar water heater Rs. 22,000/- and cost of electricity Rs. 8/kWh. Take each cylinder = 14 kgs of LPG and cost of each cylinder = Rs. 350/-.
- 13
- Q.4
- Discuss refrigeration in detail with the help of a block diagram. 10
  - Discuss the principle of HVAC in detail. 10

PART-B

- Q.5
- Define the following terms:
    - Base load.
    - Peak demand.
    - Electrical load analysis.
    - Electrolytic system.

2½ × 4

b) A generating station has the following daily load cycle:

Time (hrs)	0-6	6-10	10-12	12-16	16-20	20-24
Load (MW)	70	80	90	80	80	70

Draw the load curve and load duration curve and calculate:

i) Maximum demand.

ii) Units generated per day.

5x2

- Q.6 a) Explain life cycle costing approach in detail. 10  
b) Discuss the considerations taken for using payback period approach. 10
- Q.7 a) Discuss various types of cogeneration cycles in detail. 15  
b) Elaborate on the significance of use computers in energy management. 5

End Semester Examination, Dec. 2016  
B. Tech.– Seventh/ Eighth Semester  
ADVANCED CONTROL SYSTEM (EE-801)

Time: 3 hrs.

Max Marks:100

No. of pages:1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Attempt all questions:

- a) Define the terms:
  - i) State space.
  - ii) State vector.
- b) Explain eigen values and eigen vector.
- c) What is meant by observability?
- d) List two properties of z-transform.
- e) What is saddle point?
- f) Explain the term region of convergence (ROC).
- g) Define 'limit cycle'.
- h) List common non Linnaeites present in the system.
- i) What is pulse transfer function?
- j) Find z-transform of:

$$x_1(n) = (4, 6, 0, 2, 5, 1)$$

2×10

PART-A

- Q.2 a) Obtain the state space representation for system characterized by the differential equation  $\frac{d^3y}{dt^3} + \frac{4d^2y}{dt^2} + \frac{9dy}{dt} + 8y = 6u(t)$  where  $y$  is the output and  $u$  is the input to the system. 12

- b) Diagonalize matrix  $A = \begin{bmatrix} 1 & 4 \\ -2 & -5 \end{bmatrix}$  8

- Q.3 a) What is meant by controllability of a system? Check whether the following system is controllable or not

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -3 & 0 \\ 0 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 \\ 1 \end{bmatrix} u$$

- b) Explain state feedback design via pole placement techniques. 8

- Q.4 a) Draw and explain ROC for infinite duration sequence. 8

- b) Find  $z$  transform of  $x(n) = e^{-an}u(n)$ . 6

- c) Find inverse  $z$  transform of  $\frac{4z^2 - 2z}{z^3 - 5z^2 + 8z - 4}$ . 6

PART-B

- Q.5 a) For the given characteristic polynomial, test the stability using Jury's test.  
 $F(z) = 2z^4 + 7z^3 + 10z^2 + 4z + 1$  12

- b) State and prove sampling theorem. 8

- Q.6 a) Derive an expression for describing function for saturation nonlinearity. 10

- b) Discuss dead zone and backlash nonlinearities present in system. 10

- Q.7 a) Explain sliding mode control concept. 10



b) State the Lyapunov stability criterion for stability of a nonlinear system.

10

End Semester Examination, Dec. 2016  
B. Tech.— Seventh Semester  
UTILIZATION OF ELECTRIC POWER AND TRACTION (EE-821)

Time: 3 hrs.

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

Q.1 Answer the following:

- a) Define solid angle.
- b) What is luminous intensity?
- c) Define pinch effect.
- d) Name some materials commonly used for heating elements.
- e) What is electromechanical equivalent?
- f) The object undergoing surface plating work as \_\_\_\_\_.
- g) Define average speed and schedule speed.
- h) What are various passenger services?
- i) What are the properties of refrigerates?
- j) Explain the term tonnes of refrigeration.

2×10

PART-A

- Q.2 a) Explain construction and working of sodium vapor discharge lamps. Why sodium vapor discharge lamps are not used for general lighting? 10
- b) It is desired to illuminate a drawing hall with an average illumination of about 250 lux. The area of the hall is  $(30 \times 20) \text{m}^2$ . The lamp are to be fitted at 5 meter height. Find out the number and size of incandescent lamps required for an efficiency of 12 lumens/watt utilization factor = 0.4, maintenance factor = 0.85. 10
- Q.3 a) Discuss different methods of induction heating. 10
- b) Derive the expression for design of heating element. 10
- Q.4 a) Explain with a neat diagram submerged arc welding. 8
- b) Explain different types of welding electrodes. 6
- c) Compare AC welding and DC welding. 6

PART-B

- Q.5 a) What is electroplating? Why it is done for? Describe the various operations involved in electroplating. 7
- b) What are factor affecting the quality of electro deposition. 5
- c) A copper refining plant, using 500 electrolytic cells, carried a current of 6000 A, voltage per cell being 0.25 volt. If the plant were to work 40 hrs./week. Calculate the energy consumption per tonne. Assuming ECE of copper as 0.328/mg of electricity. 8
- Q.6 a) Discuss the various types of current collectors used in electric traction. 10
- b) Explain electrical banking in traction motors in detail. 10
- Q.7 a) What is air conditioning? Explain with the diagram window type air conditioner. 10
- b) Explain vapour absorption system and thermo-electric refrigeration system in detail. 10

End Semester Examination, Dec. 2016  
M. Tech.— First Semester  
ADVANCED POWER ELECTRONICS (EE-M-102)

Time: 3 hrs.

Max Marks: 75

No. of pages: 1

Note: Attempt FIVE questions in all. Each question carries equal marks.

- Q.1 a) Describe different modes of operation of a thyristor with the help of its static V-I characteristics. 10  
b) Describe the various types of power diodes indicating clearly the difference amongst them. 5
- Q.2 Explain constructional details and working of a low power MOSFET and a power MOSFET and bring out the differences between the two. Also discuss transfer and output characteristics of power MOSFET. 15
- Q.3 a) Describe the basic structure of MOS controlled thyristor (MCT). Give its equivalent circuit and explain turn-on and turn-off processes. 8  
b) Discuss briefly about new semiconductor materials. 7
- Q.4 a) What are the various types of snubber circuits? Explain over-voltage snubber circuit in detail. 8  
b) Draw and explain GTO snubber circuit. 7
- Q.5 a) How stray inductance is minimized in drive circuits? 7  
b) Explain dc-coupled drive circuits with unipolar output. 8
- Q.6 a) Describe any one method to design the heat Sink for thyristors. 8  
b) Give the merits and demerits of a GTO as compared to a conventional thyristor. 7
- Q.7 a) What are the various ratings of SCR? 7  
b) What is K factor? How it is important for the design of magnetic components? 8
- Q.8 Write short notes on:  
a) Special inductor design. 8  
b) Magnetic materials and cores. 7

End Semester Examination, Dec. 2016  
M. Tech. (PS ED) –FirstSemester  
POWER SYSTEM DYNAMICS AND STABILITY (EE-M-103)

Time: 3 hrs.

Max Marks:75

No. of pages:1

Note: Attempt anyFIVE questions in all. Each question carries equal marks.

Q.1 a) What do you understand by excitation system? Explain the function of each component of excitation system in detail. Name the various types of excitation system also. 7½

b) A generator is operating under steady state condition with an  $E_{fd}$  of 2.598 p.u and  $E_t = 1$  p.u. If it equipped with type AC4A excitation model, determine the value of  $v_{ref}$ . The data of exciter and regulator is given below:

$$K_A = 200, T_A = 0.04, T_C = 1.0, T_B = 12$$

$$V_{RMAX} = 5.64, V_{RMIN} = -4.53, K_C = 0$$

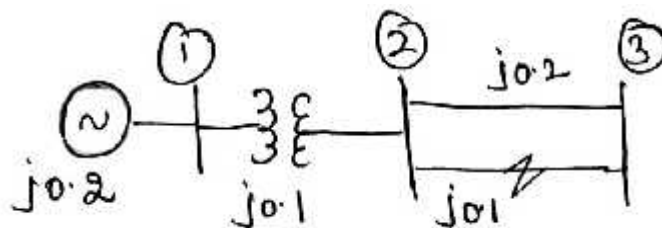
$$V_{max} = 1.0, V_{min} = -1$$

7½

Q.2 Define stability.Differentiate between the angular stability and transient stability. Explain the synchronous and damping torque with the necessary phasor diagram for the case of small signal stability. 15

Q.3 a) What do you understand by equal area criteria? Explain in detail. 7½

b) A generator has a transient reactance of 0.2 p.u. and a inertia constant of 5.66 MJ/MVA. The generator is connected to an infinite bus through a transformer and double circuit line as shown in figure. Suppose the three-phase fault occurs at mid-point of one feeder and breakers operate after certain time. Compute pre fault and faulted reduced admittance matrix.



7½

Q.4 Define sub-synchronous reactance. Explain it in detail. What are various remedies to solve SSR problems? 15

Q.5 Derive the voltage and torque equations of an induction motor. Also obtain its stator equations in park reference frame ( $dq_0$  transformations). 15

Q.6 a) What do you understand by FACTS devices? Explain the SVS system in detail. 10

b) Explain the P-V curves and Q-V curves in brief. 5

Q.7 a) What do you understand by a power system stabilizer(PSS)? How can you model PSS to improve damping? 7½

b) Obtain transfer function of a hydraulic turbine. 7½

Q.8 a) How does voltage collapse occur and what are its causes? 7½

b) Explain eigen-value and participation factor analysis in brief. 7½

End Semester Examination, Dec. 2016  
M. Tech. (PS ED) –FirstSemester  
COMPUTER AIDED POWER SYSTEM ANALYSIS(EE-M-104)

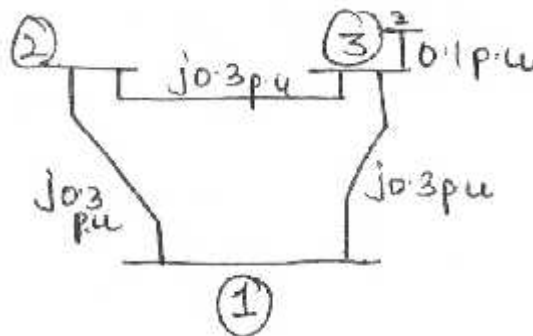
Time: 3 hrs.

Max Marks: 75

No. of pages: 2

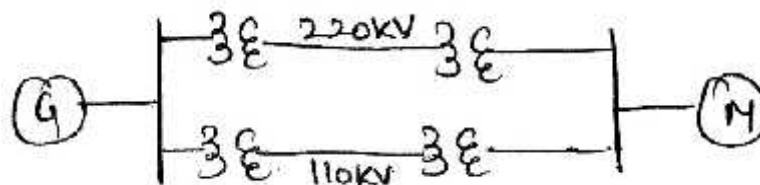
Note: Attempt any FIVE questions in all. Each question carries equal marks.

- Q.1 a) Explain the  $Z_{bus}$  building algorithm for addition of a branch and link. Develop the flowchart for the same. 7½  
b) A 3-bus power system network is shown in figure. Obtain the bus impedance matrix by using building algorithm. Take bus 1 as reference bus.



7½

- Q.2 a) Draw and explain per phase modelling or representation of all components of a power system. 7½  
b) The single line diagram of 3 power system is shown in figure. Draw its per unit impedance diagram.



G: 100 MVA, 33 kV,  $X = 20\%$   
 $T_1 = 50$  MVA, 33/2220 kV,  $X = 10\%$   
 $T_2 = 40$  MVA, 220/33 kV,  $X = 5\%$   
 $T_3 = 30$  MVA, 33/110 kV,  $X = 5.2\%$   
 $T_4 = 40$  MVA, 110/33 kV,  $X = 5\%$   
M: 80 MVA, 10.45 kV,  $X = 20\%$   
Line 1 = 115 , Line 2 = 40  
Motor: 60 MVA, 33 kV,  $X = 20\%$

7½

- Q.3 a) Development the algorithm for Newton Raphson method for power flow solution. 7½  
b) The per unit admittances are indicated at the diagram and the bus data is given in table. Determine the voltage at buses 2 and 3 after the first iteration using GuassSeidal method  $r = 1.6$ .

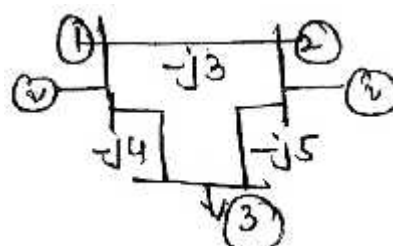
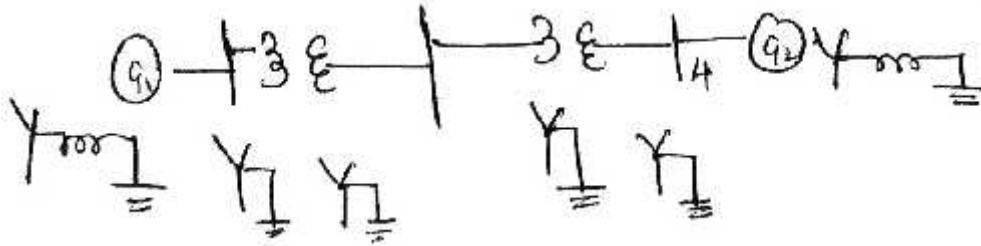


Table 2.1 Bus Data

Bus No.	Bus Type	Gen. ( $P_G Q_G$ )	Load ( $P_D Q_D$ )	Bus voltage (V $\delta$ )
1	Stack	—	—	1.02 —
2	PQ	0.25 0.15	0.5 0.25	— —
3	PQ	0 0	0.6 0.3	— —

7½

- Q.4 a) Explain are unsymmetrical faults? Also find fault current for single line to ground fault on a transmission line. 7½
- b) Determine the fault current and MVA at faulted bus for a line to ground fault at bus 4 as shown in the figure.



$G_1$  and  $G_2$  : – 100 MVA, 11 kV,  $x$  (+ve & –ve) = 15%

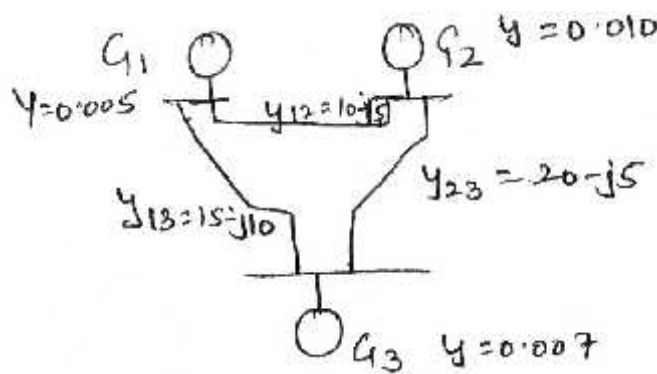
$X^o$  = 5% and  $X_n$  = 6%

$T_1$  and  $T_2$  = 100 MVA, 11/220 kV,  $X$  leakage = 9%

$L_1$  and  $L_2$  =  $X$ (+ve & –ve) = 10%,  $X^o$  = 10% on a base 100 MVA consider a fault at phase 'A'. 7½

- Q.5 a) Compare the Gauss Seidel and Newton Raphson method. 7½
- b) Derive power flow equation for a power system network. Consider  $n$  as buses for power system network. 7½

- Q.6 a) Draw the  $Y_{bus}$  or admittance matrix for the power system network.



5

All the admittances are given in mhos.

- b) Explain the contingency analysis for power system and what are the approximation in contingency analysis. 10
- Q.7 a) Explain the least square estimation of power system network and also draw the flowchart for the same. 7½
- b) Explain the static state estimation of power system using load flow studies. 7½
- Q.8 a) Explain how MATLAB can be used for solution of load flow studies or short circuit studies. 7½
- b) Write a short note on application of power system state estimation. 7½

End Semester Examination, Dec. 2016  
M. Tech. (PS ED) –FirstSemester  
INDUSTRIAL DRIVES(EE-M-105)

Time: 3 hrs.

Max Marks: 75

No. of pages: 1

Note: Attempt any FIVE questions in all. Each question carries equal marks.

- Q.1    a) Explain different classes of motor duty? 8  
      b) What are the various component of load torque? 7
- Q.2    a) Explain chopper control of separately excited dc motor. 8  
      b) Discuss closed loop control of a DC motor. 7
- Q.3    a) A 200 V, 875 rpm, 150 A separately excited DC motor has an armature resistance of 0.06  $\Omega$ . It is fed from single phase fully controlled rectifier with an AC voltage of 220V, 50Hz. Assuming continuous conduction, calculate:  
      i) Firing angle for rated motor torque at 750 rpm.  
      ii) Firing angle for rate motor torque at (-500) rpm.  
      iii) Motor speed  $\alpha = 160^\circ$  and rated torque. 8  
      b) What is the need of electric braking? Explain its various methods used in a DC motor. 7
- Q.4    Explain in detail various methods of speed control of induction motor drives. 15
- Q.5    a) Enumerate various types of synchronous motors. Derive the expression for power developed in cylindrical rotor synchronous motor. 8  
      b) Write a note on self-controlled synchronous motor drive employing load commutated thyristal inverter. 7
- Q.6    a) What is Programmable Logic Controller (PLC)? What are its various components? 8  
      b) What are the rules of a ladder diagram? Explain with an example. 7
- Q.7    a) Develop the mathematical model of an induction motor drive. 10  
      b) What are the various components of automation and explain different sensors used in automation? 5
- Q.8    Write short notes on (any three):  
      a) Steady state control.  
      b) Adaptive control.  
      c) Static Kramer drive.  
      d) DTC drive.  
      e) Dual converter DC drive. 5  $\times$  3

End Semester Examination, Dec. 2016  
M.Tech. (P.S.E.D.) -Third Semester  
HVDC AND EHVAC TRANSMISSION SYSTEMS(EE-M-301)

Time: 3 hrs

Max Marks: 75

No. of pages: 1

Note: Attempt any FIVE questions in all. Each question carries equal marks.

- Q.1 Compare EHVAC and HVDC system for power transmission. Explain the cases where EHVAC is better option than HVDC. 15
- Q.2 a) What is meant by travelling and standing waves? 5  
b) Derive an expression for voltage gradient of a two conductor line. 10
- Q.3 a) What is the requirement of reactive power in power transmission? 5  
b) Explain how reactive power can be controlled with SVC. 10
- Q.4 Write short notes on:  
a) Harmonics generation.  
b) DC harmonics filter.  
c) AC harmonic filters. 5x3
- Q.5 a) Explain the phenomenon of corona.  
b) What are the factors that affect corona?  
c) Define critical disruptive voltages and visual critical voltage. 5x3
- Q.6 a) Explain the principles of DC link control.  
b) Explain converter control characteristics. 7½x2
- Q.7 Explain modeling of DC links and find the solution of DC load flow. 15
- Q.8 Explain radio and TV interference due to EHVAC and HVDC systems and the methods to reduce them. 15



End Semester Examination, Dec. 2016  
M.Tech. (P.S.E.D.) -Third Semester  
LOAD AND ENERGY MANAGEMENT(EE-M-324)

Time: 3 hrs

Max Marks: 75

No. of pages: 2

Note: Attempt any FIVE questions in all. Each question carries equal marks.

Q.1 A steam station has two 110 MW units.

The cost of data is as under:

Unit-I

Unit capital cost =	Rs. 18000/- per kW
Fixed charge rate =	10%
Capacity factor =	0.55
Fuel consumption =	0.7 kg/kWh
Fuel cost =	Rs. 1500/- per 1000 kg.
Cost of labour =	20% of annual fuel cost.
Utilization factor =	1

Unit-II

Unit capital cost =	Rs. 3000/- per kW.
Fixed charge rate =	10%
Capacity factor =	0.60
Fuel consumption =	0.65 kg/kWh
Fuel cost =	Rs. 1500/- per 1000 kg.
Cost of labour =	15% of annual fuel cost.
Utilization factor =	1

Calculate: a) Annual plant cost and generation cost of unit-I.

b) Annual plant cost and generation cost of unit-II.

c) Overall generation cost of the station. 15

Q.2 a) Explain block meter rate tariff in brief. 5

b) The monthly electricity consumption of a residence is as under:

Light load: 5 tube light 40 W each working for 3 hrs daily.

Fan load: 3 fans 100 W each working for 5 hrs daily.

Refrigerator load: 1 kWh daily.

Misc. load: 1 kW for one hour daily.

Find the monthly bill at the following tariff.

First 15 units Rs. 2.74 per kWh.

Next 25 units Rs. 2.70 per kWh.

Remaining units Rs. 2.36 per kWh.

Constant charge Rs. 7.00 per month.

Discount for prompt payment 5%. 10

Q.3 What is load forecasting? Discuss long term load forecasting and short term load forecasting in detail. 10

Q.4 a) Explain how load curves help in the selection of size and number of generating units. 7

b) Discuss the important points to be taken into consideration while selecting generating units. 8

Q.5 a) Discuss the various roles of energy management team. 5

b) Discuss how the energy audit of heating, ventilation and air conditioning systems is done. 10

Q.6 a) Find the generation cost of a captive power plant installed in a sugar mill from the following data:  
Size of plant 25 MW , total capital cost Rs. 800 million, interest rate 10%, life of plant 20 years. The plant will use bagasse as fuel which is free of cost. Annual operation and maintenance cost 5% of capital cost, load factor 60%, subsidy 30%. 8

b) Explain various government policies regarding captive power development. 7

Q.7 a) Explain the role of central electricity regulatory commission for implementation of deregulation in India. Also enumerate its features. 8

b) What are the benefits of electricity deregulation? 7

Q.8 a) Discuss the organization of power sector in India. 9

b) Give the main provisions of Grid code. 6

End Semester Examination, Dec. 2016  
B. Tech.— First/ Second Semester  
ELEMENTS OF MECHANICAL ENGINEERING (M-101C)

Time: 3 hrs.

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

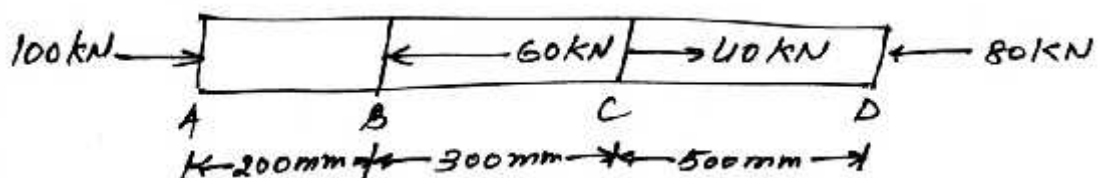
- Q.1
- Define mechanical, chemical, thermal and thermodynamic equilibrium respectively.
  - Define 'refrigeration'.
  - Differentiate between 'spur gear' and 'helical gear'.
  - Define 'compression ratio'.
  - Define 'angle of contact in belt'.
  - Write down the classification of plain carbon steel.
  - Define 'poisson's ratio'.
  - Define 'mechanical advantages'.
  - What is Hook's law?
  - Define 'strength and hardness'.
- 2×10

PART-A

- Q.2
- Define 'first law of thermodynamics' for a cyclic process. 10
  - A heat engine produces work equivalent to 80 KW with an efficiency of 40%. Determine heat transfer rate to and from working fluid. 10
- Q.3
- Derive an expression for the length of belt for cross-belt system. 10
  - Explain the gear terminology with the help of suitable diagrams. 10
- Q.4
- Explain the working of 4-stroke petrol engine in detail with the help of sketches. 12
  - Write down the various applications of refrigeration. 8

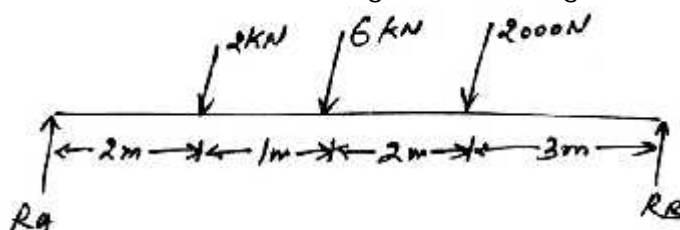
PART-B

- Q.5
- Draw the stress-strain diagram and explain it. 10
  - A member ABCD of uniform diameter 200 mm has been subjected to point loads as shown in the figure given below. Determine the net change in the length of the bar. Take modulus of elasticity of the bar material as  $E = 200 \text{ GN/m}^2$ .



10

- Q.6 Draw the shear force and bending moment diagram for the following system:



20

- Q.7    a) Explain the classification of engineering materials in detail.  
      b) Explain arc welding process in detail with diagram.

10×2

End Semester Examination, Dec. 2016  
B. Tech.–Second Semester  
APPLIED MECHANICS (M-201)

Time: 3 hrs

Max Marks: 100

No. of pages: 2

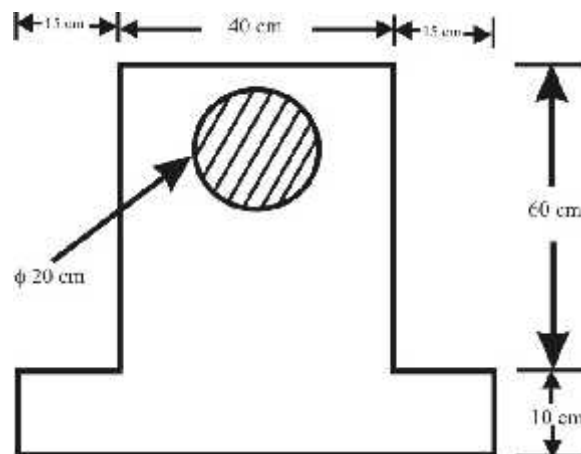
Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

- Q.1
- Write the statement for "triangle law" of forces.
  - What are the various assumptions made in mechanics (idealization).
  - Explain the "Parallel axis theorem" with a diagram.
  - Derive  $I_{xx}$  of a rectangle with breadth 'b' and depth 'd'.
  - Define "free body diagram" and state the importance of drawing such a diagram.
  - Differentiate between "perfect" and "imperfect" trusses.
  - Derive the second equation of motion.
  - At what angle a projectile should be projected in order to have maximum range. Justify your answer by calculations.
  - Explain "general plane motion" with diagram.
  - Explain work done by couple.

2x10

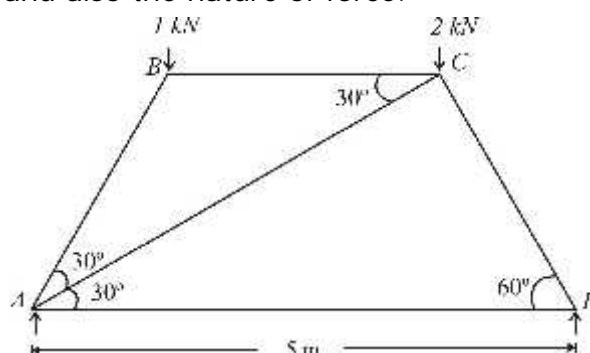
PART-A

- Q.2
- State and prove Varignon theorem. 8
  - The forces 20 N, 30 N, 40 N, 50 N and 60 N are acting at one of the angular points of a regular hexagon, towards the other five angular points, taken in order. Find the magnitude and direction of the resultant force. 12
- Q.3
- Explain the method of finding out the moment of inertia of a composite section. 6
  - Find the moment of inertia of the given section about centroidal X and Y axis.



14

- Q.4
- The figure shows a framed structure of 5 m span. Find the forces in the members of the structure and also the nature of force.

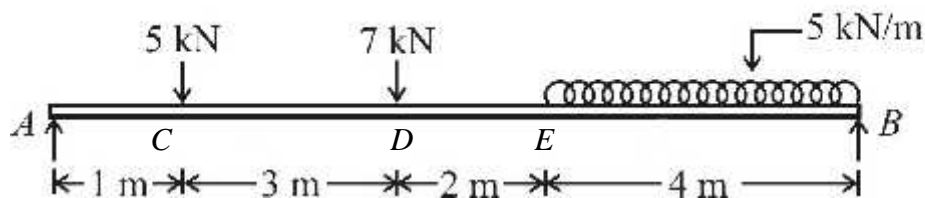


15

- b) Differentiate between "method of joints" and "method of sections". 5

### PART-B

- Q.5 a) A stone is thrown vertically upwards from the ground with a velocity 49 m/s. After 2 seconds, another stone is thrown vertically upwards from the same place. If both the stone strikes the ground at the same time, find the velocity with which the second stone was thrown upwards. 12
- b) A body is projected at such an angle that the horizontal range is three times the greatest height. Find the angle of projection. 8
- Q.6 a) Explain the concept of instantaneous centre of rotation. 5
- b) A train is moving along a track whose gradient is 1 in 100. The weight of train is 6000 kN. The train is brought to rest applying brakes in 250 m length along the track. The resistance due to friction and air motion is 15 N per kN weight of the train. Find the WD in bringing the train to rest. (WD=Work Done) 15
- Q.7 a) A simply supported beam AB of span 10 m is loaded as shown in the figure. Calculate the reactions  $R_A$  and  $R_B$  by the method of "virtual work".



- b) Differentiate between "translation and rotation" with suitable diagrams. 5

End Semester Examination, Dec. 2016  
B. Tech. – Second Semester  
ENGINEERING MATERIALS AND HEAT TREATMENT(M-202)

Time: 3 hrs.

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

- Q.1
- a) What is hypo-eutectoid steel?
  - b) What is surface hardening process?
  - c) What is dead mild steel?
  - d) Define 'composite materials'.
  - e) Why do we add chromium to steel?
  - f) What is crevice corrosion?
  - g) Write down the names of various quenching media.
  - h) What are allotropes of iron?
  - i) Write down the applications of bronze.
  - j) Define: 'strength' and 'hardness'.
- 2 × 10

PART-A

- Q.2
- a) What are engineering materials? Classify them with the help of a line diagram and discuss briefly. 12
  - b) Discuss the copper and aluminium materials in detail. 8
- Q.3
- Write short notes on:
- a) Optical fiber.
  - b) Glass ceramic.
  - c) Clay product.
  - d) Particle reinforced composite. 5 × 4
- Q.4
- a) What is impact testing? Discuss the procedure of impact testing and advantages of impact testing in detail. 10
  - b) What is creep? Discuss it in detail with the help of a line diagram. 10

PART-B

- Q.5
- a) What happens when we add upto 5% carbon to iron? Draw a well labeled diagram to show the various changes and mark all the temperatures and compositions. 15
  - b) Write down the advantages of c-curve in brief. 5
- Q.6
- a) What is hardening by quenching? Write down the procedure to perform the hardening. Give its advantages also. 10
  - b) What do you mean by burning of steel? How it happens? Discuss in detail. 10
- Q.7
- a) What is cyaniding? Why do we need it? Give its advantages and procedure in detail.
  - b) Explain flame hardening process with neat sketch in detail. 10 × 2

End Semester Examination, Dec. 2016  
B. Tech.–Third Semester  
ENGINEERING MECHANICS (M-301A)

Time: 3 hrs.

Max Marks: 100

No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Briefly explain:

- a) Explain the principle of transmissibility of forces.
- b) Resultant of a force system.
- c) Importance of drawing free body diagram.
- d) Varignon's theorem.
- e) Perfect, deficient and redundant frame.
- f) Normal acceleration and tangential acceleration in case of curvilinear motion?
- g) Dynamic equilibrium.
- h) Principle of virtual work.

$2\frac{1}{2} \times 8$

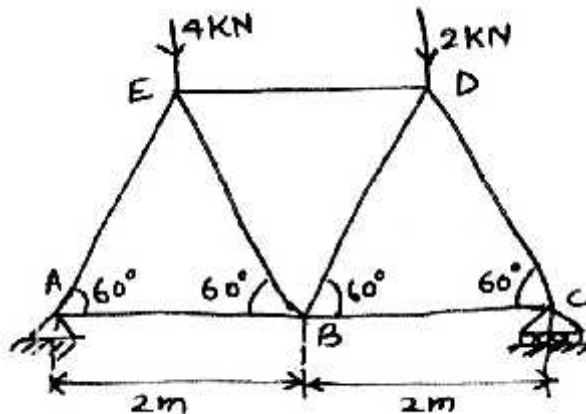
PART-A

Q.2 Determine the magnitude and direction of the resultant of the following set of forces acting on a body.

- a) 200 N inclined  $30^\circ$  with east north,
- b) 250 N toward the north,
- c) 350 N inclined at  $40^\circ$  with west toward south,
- d) 300 N toward North West.

$5 \times 4$

Q.3 Determine the reaction and the forces in each member of a simple triangle truss supporting two loads as shown in the figure.



20

- Q.4 a) Write down the position of centre of gravity for the following regular solids: cylinder, sphere, hemisphere, and right circular cone. 5
- b) The moment of inertia of rectangular section beam about  $x-x$  and  $y-y$  axes passing through the centroid are  $250 \times 10^6 \text{ mm}^4$  and  $40 \times 10^6 \text{ mm}^4$  respectively. Calculate the size of the section. 15

PART-B

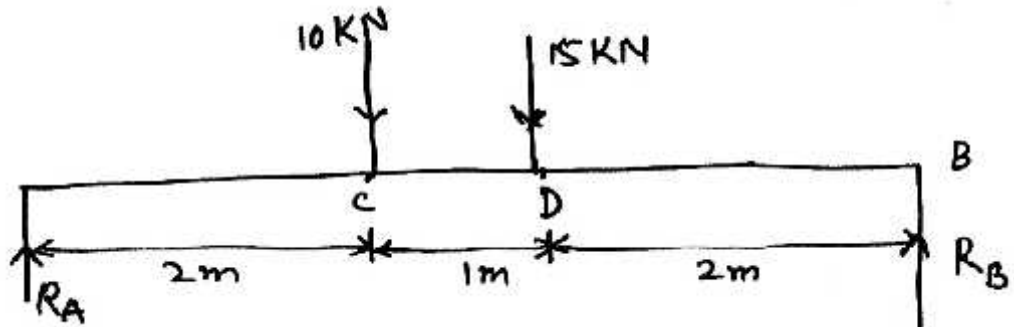
Q.5 A particle moves in  $x-y$  plane and its coordinates are defined by the relations:  
 $x = -3 \sin t$  and  $y = 2 - 3 \cos t$ .

where  $x$  and  $y$  are in meters and time  $t$  is in seconds. State the equation of path along which the particle moves. 20



Q.6 A train weighing 4000 kN has frictional resistance of 5 N/kN of weight. Determine the steady pull which locomotive must exert if the speed of the train is to be increased from 30 km/hr to 60 km/hr within a period of 1.5 minutes. 20

- Q.7 a) How will you determine the force in a member of a framed structure with the help of principle of virtual work. 8  
b) A beam has been loaded and supported as shown in the figure. Use the method of virtual work to determine the reaction at end supports.



End Semester Examination, Dec. 2016  
B. Tech.– Third Semester  
THERMAL ENGINEERING-I (M-302)

Time: 3 hrs.

Max Marks: 100

No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

Q.1 Briefly answer:

- a) Define an open system, a closed system and an isolated system.
- b) Define the equilibrium states in thermodynamic equilibrium.
- c) Define the limitations of the first law of thermodynamics.
- d) What is an ideal gas?
- e) How evaporation differs from boiling?
- f) Distinguish between proximate analysis and ultimate analysis.
- g) Define the 'entropy' and 'enthalpy'.
- h) Define the 'perpetual motion machine of the second kind'.
- i) What is meant by a phase of a system and pure substance?
- j) What are processes occur in a Brayton cycle?

2 × 10

PART-A

- Q.2 a) Define the saturation temperature, superheated steam and triple point with the help of graph. 10
- b) Explain the Mollier Chart with a neat graph. 10

- Q.3 a) i) Draw the T-S and P-V diagram of Carnot cycle.  
ii) What do you mean by Clausius inequality?  
iii) Define the reversible and irreversible processes.  
iv) Write two similarities of heat and work.  
v) Define a reverse heat engine. 2 × 5
- b) The pressure-volume correlation for a non-flow quasistatic process is given by  $p = (u - 4V)$  bar, where  $V$  is in  $\text{m}^3$ . If 150 kJ of work is supplied to the system, determine the final pressure and volume of the system. Take the initial volume =  $0.6 \text{ m}^3$ . 10

- Q.4 a) Draw the schematic diagram of a heat engine, a refrigerator and a heat pump; and differentiate between them. 10
- b) In a certain steam power plant, the steam generated at the boiler is fed to the steam turbine via steam header (I.D. = 200 mm). The generated steam conditions are : Steam pressure = 4 MPa, steam temperature =  $673^\circ\text{K}$ , specific enthalpy of steam =  $0.073 \text{ m}^3/\text{kg}$ .  
But due to heat leakage through insulation of the steam header at the rate of 8.5 kJ/kg of steam condition at turbine inlet are different: Steam pressure drops to 3.5 MPa, temperature falls to 655 K, specific enthalpy of steam at turbine inlet = 3202.06 kJ/kg, specific volume of steam at turbine inlet =  $0.084 \text{ m}^3/\text{kg}$ . Determine the steam flow rate. 10

PART-B

- Q.5 a) Explain with a sketch, the constructional and operational aspects of an Orsat apparatus used for analyzing the flue gases from a boiler trial. 10

- b) What are the characteristics of an ideal fuel? Determine the stoichiometric air-fuel ratio and the products of combustion of octane,  $C_8H_{18}$ . 10
- Q.6 a) A refrigerator operates on a reverse Carnot cycle whose COP is 5.5. The evaporator is maintained at a temperature of  $(-0.6^\circ C)$ . The power required to run the refrigerator is 3.7 kW. Find the refrigerating and condenser temperature of the refrigerator. 10
- b) Prove that the entropy is constant. Derive an expression for the entropy change in an irreversible process. 10
- Q.7 a) State the Kelvin-Planck and Clausius statement of the second law of thermodynamics. Prove the equivalence between them. 8
- b) What is entropy? Define the available energy, unavailable energy, total energy and energy? When does the system become dead? 7
- c) How does an ideal gas differ from a perfect gas? 5

End Semester Examination, Dec. 2016  
B.Tech-Third Semester  
MANUFACTURING TECHNOLOGY-I (M-303A)

Time: 3 hrs

Max Marks:100

No. of pages: 1

Note: Attempt any FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from part-A and TWO questions from part-B. Each question carries equal marks.

- Q.1
- a) What is green sand?
  - b) What are the main constituents of moulding sand?
  - c) What are the requirements of gating system?
  - d) What is riser?
  - e) What is hot working and cold working?
  - f) What is coining?
  - g) What is bending operation?
  - h) What is a lap joint?
  - i) Why is the coating of electrode done?
  - j) What is brazing?
- 2x10

PART-A

- Q.2
- a) Explain the various types of patterns used in foundry shop in detail. 10
  - b) What are different types of core? Explain any one core with the help of a neat sketch. 5
  - c) Explain the various additives commonly added to the moulding sand. 5
- Q.3
- a) Explain the following in brief:
    - i) Semi – Centrifugal casting.
    - ii) Centrifuge casting. 5x2
  - b) Explain the brief the cleaning of casting. 10
- Q.4
- a) What is rolling? Explain three high rolling mill, four high rolling mill and cluster rolling mill in detail. 10
  - b) Explain direct extrusion with a sketch. 5
  - c) Sketch and explain wire drawing in brief. 5

PART-B

- Q.5
- a) Sketch and explain the following operations:
    - i) Deep drawing.
    - ii) Stretch forming. 5x2
  - b) Distinguish between embossing and coining. 5
  - c) Distinguish between blanking and punching. 5
- Q.6
- a) Explain the principle of arc welding with the help of a neat sketch. What is straight polarity and reverse polarity? 10
  - b) What is the principle of gas welding? 5
  - c) Compare AC power source welding and DC power source welding in brief. 5
- Q.7
- a) Explain the thermit welding process with the help of a neat sketch. What are the applications of this process? 10
  - b) Write short notes on the following:
    - i) Spot welding.
    - ii) Seam welding. 5x2

End Semester Examination, Dec. 2016  
B. Tech.– Third/ Fourth Semester  
FLUID MECHANICS(M-304A)

Time: 3 hrs

Max Marks: 100

No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

- Q.1
- a) Define vapor pressure.
  - b) Define the term 'buoyancy'.
  - c) What is continuity equation?
  - d) What is laminar flow?
  - e) Define vena-contracta.
  - f) What is orifice-meter?
  - g) What do you mean by 'viscous flow'?
  - h) Define Reynold's number.
  - i) Explain the term 'co-efficient of friction'.
  - j) Explain the term 'equivalent pipe'.

2x10

PART-A

- Q.2
- a) Explain the terms: (i) Dynamic viscosity (ii) Kinematic viscosity. 4
  - b) What is a manometer? How are they classified? 6
  - c) A rectangular plane surface 2m wide and 3m deep lies in water in such a way that its plane makes an angle of  $30^\circ$  with the free surface of water. Determine the total pressure and position of centre of pressure when the upper edge is 1.5m below the free water surface. 10
- Q.3
- a) Define the equation of continuity. Obtain an expression for continuity equation for a three-dimensional flow. 10
  - b) A 40cm diameter pipe carrying water, branches into two pipes of diameter 30cm and 20cm, respectively. The average velocity in the 40cm pipe is 3m/s. Find the discharge in this pipe. Also determine the velocity in 20cm pipe if the average velocity in 30cm diameter pipe is 2m/sec. 10
- Q.4
- a) What is Euler's equation of motion? How will you obtain Bernoulli's equation from it? 10
  - b) An oil of special grade 0.8 is flowing through a venturimeter having inlet diameter 20cm and throat diameter 10cm. The oil-mercury differential manometer shows a reading of 25cm. Calculate the discharge of oil through the horizontal venturimeter. Take  $C_d=0.98$ . 10

PART-B

- Q.5
- a) An oil of viscosity  $0.1 \text{Ns/m}^2$  and relative density 0.9 is flowing through a circular pipe of diameter 50mm and of length 300m. The rate of flow of fluid through the pipe is 3.5litres/sec. Find the pressure drop in a length of 300m and also the shear stress at the pipe wall. 15
  - b) Describe Reynold's experiment to demonstrate the types of flow. 5
- Q.6
- a) Derive an expression for the loss of head due to friction in pipes. 10
  - b) Explain boundary layer separation. What are the different methods of preventing the separation of boundary layers? 10

- Q.7 a) Find the loss of head when a pipe of diameter 200mm is suddenly enlarged to a diameter of 400mm. The rate of flow of water through the pipe is 250litres/sec. 10
- b) A partially submerged body is towed in water. The resistance  $R$  to its motion depends on the density  $\ell$ , the viscosity  $\sim$  of the water, the length  $l$  of the body, velocity  $v$  of the body and the acceleration due to gravity  $g$ . Show that the resistance to the motion can be expressed in the form:

$$R = \rho l^2 v^2 \left[ \left( \frac{\sim}{\ell v l} \right), \left( \frac{l g}{v^2} \right) \right].$$

# End Semester Examination, Dec. 2016

## B.Tech-Third Semester MATERIAL SCIENCE (M-305)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt any FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from part-A and TWO questions from part-B. Each question carries equal marks.

- Q.1
- a) Define 'unit cell' of a space lattice.
  - b) What do you mean by imperfection in metal crystals?
  - c) What information do we get from study of a phase diagram?
  - d) Name different types of solid solutions.
  - e) What is the purpose of heat treatment?
  - f) What do you understand by deformation of metals?
  - g) What is Bauschinger effect?
  - h) How corrosion takes place?
  - i) How polymers are formed?
  - j) Write the properties of composite materials. 2x10

### PART-A

- Q.2
- a) Define Atomic Packing Factor (APF). Obtain the APF expression for Body Centered Cubic (BCC). 10
  - b) Differentiate between 'edge and screw dislocations in solids'. 10
- Q.3
- Draw Fe-Fe<sub>3</sub>C phase diagram and label the phase fields. Discuss in brief the different reactions that take place in this system. 20
- Q.4
- a) Why annealing is done? Describe the process of annealing heat treatment process for a plain carbon steel. 12
  - b) Write the properties of ferrite and martensite structure of material. 8

### PART-B

- Q.5
- a) Draw creep curve and explain the mechanism of creep in detail. 10
  - b) Describe the causes, effects and prevention of corrosion in detail. 10
- Q.6
- a) What are fibre reinforced composites (FRC)? Explain the characteristics of materials essential for designing FRC. 10
  - b) Explain the basic steps in the processing of ceramic products. 10
- Q.7
- a) Differentiate between 'elastic and plastic deformation'. Write the mechanism of plastic deformation in detail. 10
  - b) What are the causes of failures in metals? Explain different types of mechanical failure in detail. 10

End Semester Examination, Dec. 2016  
B.Tech-Third Semester  
MATERIAL AND HEAT TREATMENT (M-307)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

- Q.1
- a) Define 'ferrous materials'.
  - b) Name different types of cast iron.
  - c) What are advantages of composite materials?
  - d) Write the properties of refractory materials.
  - e) What is impact test?
  - f) What is heat treatment process?
  - g) Name different heat treatment process.
  - h) What is chemical heat treatment?
  - i) Why surface hardening is done on a material?
  - j) What do you mean by fatigue failure?
- 2x10

PART-A

- Q.2
- a) Classify ferrous materials and explain the composition, properties of plain carbon steels. 10
  - b) Name different types of non-ferrous materials. Write their applications and limitations. 10
- Q.3
- a) What do you understand by composite materials? How will you classify composite materials? Write their advantages and limitations. 10
  - b) Write the name of different ceramic materials and briefly describe any one of them. 10
- Q.4
- a) What are the mechanical properties of materials? Discuss any one property in detail. 10
  - b) What do you mean by mechanical failure of a component? Explain corrosion phenomenon in detail. 10

PART-B

- Q.5
- a) What do you understand by phase transformation during heat treatment process? Describe the austenite formation in Fe-c equilibrium diagram. 10
  - b) What are the effects of alloying elements on a material? 10
- Q.6
- a) What are different heat-treatment process? Explain any one in detail. 10
  - b) Explain the defects in case of overheating and burning of steel during heat treatment. 10
- Q.7
- a) Describe post heat treatment process of carburized parts in detail. 10
  - b) Explain the flame and induction hardening process in detail. 10



End Semester Examination, Dec. 2016  
B. Tech. (Mech. Engg. / Mech. Engg.II) – Third Semester  
METROLOGY(M-308)

Time: 3 hrs.

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

- Q.1
- a) Differentiate between 'line standard' and 'end standard'.
  - b) State the Taylor's principle of limit gauging.
  - c) Define 'unilateral' and 'bi-lateral tolerance'.
  - d) What is progressive type of solid plug gauge?
  - e) Write down the principle and use of sine bar.
  - f) What is "best size" wire?
  - g) What are the different types of irregularities found in circular parts?
  - h) What is primary and secondary texture?
  - i) Name commonly used methods of checking flatness.
  - j) Define circular pitch, diametric pitch and module of a gear.
- 2 × 10

PART-A

- Q.2
- a) Why it is necessary to give tolerance on engineering dimensions? 5
  - b) Determine the dimensions, tolerances and allowances for 27 mm hole and shaft pair designated as H<sub>7</sub>e<sub>8</sub>.  
Given:
    - i) Upper deviation of "e" shaft =  $-11 D^{0.41}$ .
    - ii) 27mm lies in the diameter steps of 18mm to 30mm.
    - iii) 1T7 = 16i.
    - iv) 1T8 = 25i.
- 15
- Q.3
- a) Explain the difference between a measuring instrument and comparator. 5
  - b) With a neat sketch, describe the working principle of a pneumatic comparator. 15
- Q.4
- a) Define the following terms with reference to surface roughness:
    - i) Ra-value.
    - ii) Rq-value.
    - iii) R<sub>3</sub>-value.
    - iv) Sampling length.
    - v) Lay.
  - b) Describe the principle and operation of a Taylor-Hobson-Talysurf roughness instrument for the measurement of surface roughness.
- 1 × 5  
15

PART-B

- Q.5
- a) Name the various types of pitch errors found in a screw thread. 5
  - b) Describe with a neat sketch, the two-wire method of measuring effective diameter of an external thread. 15
- Q.6
- a) Define 'straightness error'. Name commonly used methods of measuring straightness. 5
  - b) Describe the spirit level or auto collimator method of measuring straightness of a surface. 15
- Q.7
- a) Name the various element of a spur gear which are checked for accuracy. 5
  - b) Describe the working principle of a Parkinson gear tester and state its limitations. 15

# End Semester Examination, Dec. 2016

B. Tech.– FourthSemester

## THERMAL ENGINEERING-II (M-401A)

Time: 3 hrs.

Max Marks:100

No. of pages:2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

- Q.1
- Write down four classifications of I.C. engine.
  - Define 'swept volume'.
  - What is scavenging?
  - What is function of carburettor?
  - Draw P-V diagram of dual cycle engine with indication of processes.
  - What is difference between refrigeration and air-conditioning?
  - What is definition of tonnage of refrigeration?
  - Prove ITR of refrigeration = 3.5 KW.
  - What is dew point temperature?
  - How does evaporator work in a refrigeration cycle?
- 2×10

### PART-A

- Q.2
- Explain the phenomenon of knock in I.C engine. Also describe preignition in brief. 10
  - Describe with a diagram principle of operation of simple carburettor. 10
- Q.3
- Draw P-V and T-S diagram of Otto cycle. Explain its each process and derive an expression of air standard efficiency. 10
  - An engine working on Otto cycle has a volume of  $0.5 \text{ m}^3$ , pressure 1 bar and temperature  $27^\circ\text{C}$  at the beginning of compression stroke. At the end of compression stroke, the pressure is 10 bar. 210 KJ heat is added during constant volume heating process. Calculate the pressures, temperatures and volumes at salient points in the cycle. Also find the percentage clearance, efficiency. 10
- Q.4
- Draw and describe actual valve timing diagram for 4-stroke Otto cycle engines and 4-stroke diesel cycle engines. 10
  - Write down effects of detonation. 5
  - Write down the factors affecting knock. 5

### PART-B

- Q.5
- Deduce the designation of Refrigerants from following chemical formulas:  
 $\text{CH}_4$ ,  $\text{C}_2\text{H}_6$ ,  $\text{C}_3\text{H}_8$ ,  $\text{CCl}_2\text{F}_2$ ,  $\text{CHClF}_2$  2×5
  - Deduce COP of Bell-coleman cycle with cycle diagram, P-V diagram and T-S diagram. 10
- Q.6
- The atmospheric air at  $30^\circ\text{C}$  dry bulb temperature and 75% relative humidity enters a cooling coil at the rate of  $200 \text{ m}^3/\text{min}$ . The coil dew point is  $14^\circ\text{C}$  and the bypass factor of the coil is 0.1. Determine:
- The temperature of the air leaving the cooling coil.
  - The capacity of the coil in Tonnes of refrigeration and in kilowatt.
  - The amount of water vapour removed per minute.
  - The sensible heat factor for the process.
- 20

Q.7 a) Show  $y_v = 1 + c - c \left( \frac{P_2}{P_1} \right)^{\frac{1}{\gamma}}$  drawing P-V diagram where;

$c$  = clearance factor,  $P$  = Pressure

$y_v$  = volumetric efficiency of reciprocating compressor.

10

b) Draw a vapour compression cycle and describe the same with the help of pressure-enthalpy (P-h) diagram.

10

End Semester Examination, Dec. 2016  
B. Tech.– Fourth / Fifth Semester  
FLUID MACHINES AND TURBOMACHINERY (M-402A)

Time: 3 hrs.

Max Marks: 100

No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

- Q.1
- What is the hydraulic life?
  - What is the hydraulic intensifier?
  - What is scale effect?
  - Why a reciprocating pump is called a positive displacement pump?
  - What is effect of Air vessels?
  - State the purpose of draft tube in a reaction turbine.
  - Enumerate the salient points of difference between the centrifugal and reciprocating pumps.
  - Hydraulic turbines are classified according to head, discharge and specific speed. Explain the above terms.
  - What do you mean by impulse momentum principle?
  - What do you mean by gross head and net head?
- 2 × 10

PART-A

- Q.2
- Show that when a jet of water impinges on a series of curved vanes, maximum efficiency is obtained when the vane is semi-circular in section and the velocity of vane is half that of jet. 10
  - A jet of water, 2.5 cm diameter and moving at 15 m/s, strikes upon centre of a symmetrical vane. After impingement, the jet gets deflected through  $160^\circ$  by the vane. Presuming vane to be smooth, calculate the thrust exerted by the jet on the vane. 10
- Q.3
- A Pelton turbine is to work at the foot of dam whose reservoir level is 220 m. The head at the full opening at the turbine nozzle is 200 m and coefficient of velocity is 0.98. The turbine is to operate at 200 rpm and develop a power of 3.7 MW. Assuming blade to jet ratio as 0.46, estimate the wheel diameter. If the blade outlet angle is  $16^\circ$ , determine the blade and hydraulic efficiencies neglecting friction losses. 20
- Q.4
- Define cavitation, why does it occur and what are its effects? 10
  - A Kaplan turbine develops 1500 kW power at average head of 30 meter. The speed and flow ratios are 2.1 and 0.62 respectively. The diameter of boss = 0.4 times the external diameter of runner. Overall efficiency being 90%, calculate diameter and speed of runner. 10

PART-B

- Q.5
- Centrifugal pump has suction lift of 2 meter and delivery tank is 15 meter above the pump. The velocity of water in delivery pipe is 2 m/sec. The radial velocity of flow through the wheel is 4 m/sec and vanes are curved backwards at an angle  $40^\circ$  with the tangent. Assume water enters radially and neglecting friction losses. Find:
- Velocity of water at exit.
  - Pressure head at wheel exit.
  - Direction of fixed guide vane.
- 20

Q.6 Explain the working principle of a reciprocating pump. Why a reciprocating pump is called a positive displacement pump? A single acting reciprocating pump has the plunger diameter of 20 cm and stroke of 30 cm. Pump discharges  $0.53 \text{ m}^3$  of water per minute at 60 rpm. Find the theoretical discharge and percentage slip of pump. Further if suction and delivery heads are 4 m and 12 m respectively, work out power required to run the pump. 20

Q.7 Explain with a neat sketch construction and operation of the following hydraulic devices:  
a) Simple accumulator.  
b) Hydraulic crane and lift.  
c) Hydraulic ram. 20

End Semester Examination, Dec. 2016  
B. Tech. —Third / Fourth Semester  
STRENGTH OF MATERIAL (M-403A)

Time: 3 hrs.

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

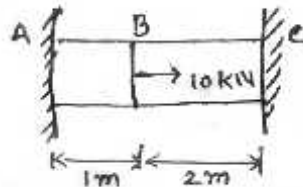
Q.1 Define the following: (ANY TEN)

- |                             |                        |
|-----------------------------|------------------------|
| a) Brittle material.        | b) Shear strain.       |
| c) Factor of safety.        | d) Temperature stress. |
| e) Thin cylindrical vessel. | f) Simple bending.     |
| g) Flitched beam.           | h) Proof resilience.   |
| i) Angle of twist.          | j) Elastic stability.  |
| k) Helix angle of spring.   | l) Hoop stress.        |

2 × 10

PART-A

Q.2 A prismatic bar as shows in figure carries an axial load 10 kN. Calculated the reaction at the supports assuming them rigid. 20



Q.3 Explain theory of simple bending and derive the bending formula. 20

Q.4 A hollow shaft of diameter ratio  $\frac{3}{5}$  is required to transmit 800 KW at 110 r.p.m., the maximum torque being 20% greater than mean. The shear stress is not to exceed 63 MPa and the twist in a length of 3 m is not to exceed  $1.4^\circ$ , Calculate the minimum external diameter satisfying these conditions? 20

PART-B

Q.5 a) Explain stresses developed in a circular bar due to impact load and derive the formula. 8

b) A bar 3 m long, 3 cm diameter hangs vertically and has a collar securely attached at the lower end. Find the maximum stress induced, when a weight of 25 kN falls 12.5 cm on the collar. Take  $E = 200 \text{ GPa}$ . 12

Q.6 a) Derive the equation of change in volume of the cylinder.

b) A cast iron pipe is 1.25 m diameter and is required to withstand 100 m head of water. Assuming limiting tensile stress for the pipe material as 21 MPa, determine the thickness of metal.  $10 \times 2$

Q.7 Derive the Euler's formulas for (a) column hinged at both ends and (b) fixed at both ends. 20

End Semester Examination, Dec. 2016  
B. Tech. — Fourth Semester  
MANUFACTURING TECHNOLOGY-II (M-404A)

Time: 3 hrs.

Max Marks: 100

No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

- Q.1
- Describe a tool with 8, 10, 6, 6, 6, 10, 2 signature in A.S.A system.
  - How do you expect the coating on tools to improve machining performance?
  - State the thermal aspects of metal machining.
  - Identify the variables that affect machinability.
  - State the functions of cutting fluid in machining.
  - Explain the working of a "3 jaw self-centering" chuck or scroll chuck.
  - With the help of a neat sketch show how grooving and knurling is done?
  - Differentiate between drilling, boring and reaming.
  - A steel piece 100 mm long is to be taper turned for a length of 40 mm from its one end. Diameter of the work piece is 20 mm and the smaller end is a point. Find the angle through which the compound rest should be swiveled to turn the taper.
  - How a push broach differs from a pull broach? 2 × 10

PART-A

- Q.2
- Explain earnest-merchant force circle diagram and analyse the various force relations resulting from it. 10
  - Prove that: 
$$W = \frac{r \cos x}{1 - r \sin x}$$
where "W" is the shear angle.  
"r" is the chip thickness ratio.  
"x" is the rake angle. 10
- Q.3
- What are "crater wear" and "flank wear"? Explain. 5
  - What are the common wear mechanism causing wear on cutting tools? Explain in brief. 7
  - What are the main factors which influence the tools life? 8
- Q.4
- Derive the relationship for the following:
- Minimum cost-cutting speed.
  - Maximum production rate cutting speed in a single point turning of a cylindrical work piece. State the assumptions made. 10 × 2

PART-B

- Q.5
- Write short notes on the following(Any Five):
- Compound rest of a lathe.
  - Face plate and angle plate.
  - Size and specifications of a lathe.
  - Operations done on a drill machines.
  - Up-milling and down milling.
  - Principle mechanisms of shaper, planar and slotter. 4 × 5
- Q.6
- Why is correct setting of turning tools necessary? What happens if it is set wrongly? 5
  - State effects of rake angle, relief angle and nose radius on machining. 5

c) Describe the various taper turning processes used for production of tapered work on lathes. 10

Q.7 a) Draw a neat sketch of a twist drill showing different parts, principal dimensions and different angles. 10

b) Define cutting speed, feed and depth of cut as they are referred to drilling and explain how machining time in drilling is calculated. 10



End Semester Examination, Dec. 2016  
B. Tech.–FourthSemester  
KINEMATICS OF MACHINES(M-405A)

Time: 3 hrs

Max Marks: 100

No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

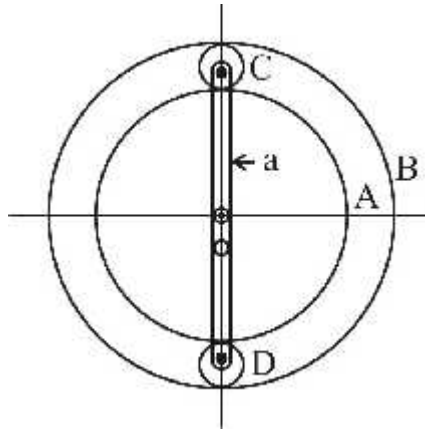
Q.1 Explain the following in brief:

- a) Self closed pair.
- b) Ternary joint
- c) Interference of teeth.
- d) Arc of recess.
- e) Speed ratio.
- f) Compound gear train.
- g) Cylindrical cam.
- h) Dwell period.
- i) Chebychev's spacing.
- j) Instantaneous center.

2x10

PART-A

- Q.2 a) Describe, with the help of a neat sketch, one inversion of a double slider crank chain. 7
- b) A crank and slotter lever mechanism used in a shaper has a centre distance of 300 mm between the centre of oscillation of the slotted lever and centre of rotation of the crank. The radius of the crank is 120 mm. Find the ratio of the time of cutting to time of return stroke. 7
- c) Differentiate between incompletely and successfully constrained motions. 6
- Q.3 a) Derive the minimum number of teeth on the pinion in order to avoid the interference. 10
- b) The number of teeth on each of the two equal spur gears in mesh are 40. The teeth have  $20^\circ$  involute profile and the module is 6 mm. If the arc of contact is 1.75 times the circular pitch, find the addendum. 10
- Q.4 a) An epicyclic gear train is shown in the figure. The number of teeth on A and B are 80 and 200. Determine the speed of the arm 'a':
- i) If A rotates at 100 rpm clockwise and B at 50 rpm counter-clockwise.
  - ii) If A rotates at 100 rpm clockwise and B is stationary.

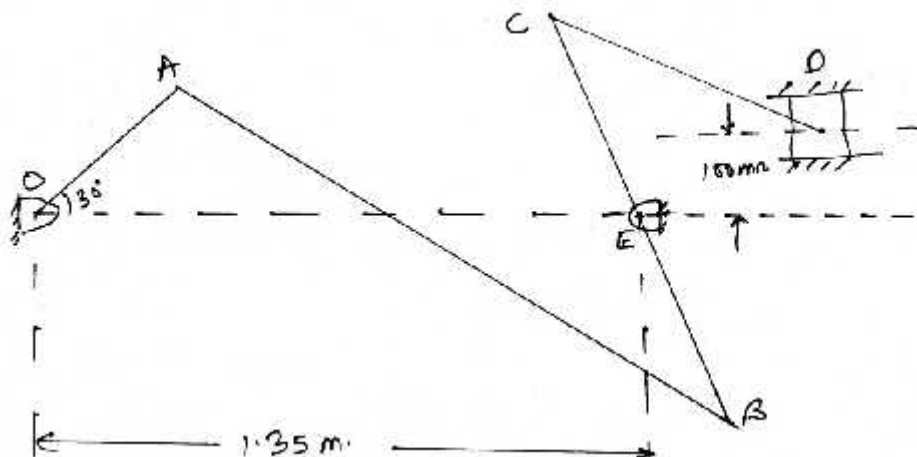


- b) Explain the reverted gear train.

14  
6

### PART-B

- Q.5 A cam is to be designed for a knife edge follower with the following data:  
 a) Cam lift = 40 mm during  $90^\circ$  of cam rotation with simple harmonic motion.  
 b) Dwell for the next  $30^\circ$ .  
 c) During the next  $60^\circ$  of cam rotation, the followers return to its original positions with simple harmonic motion.  
 d) Dwell during the remaining  $180^\circ$ .  
 Draw the profile of the cam when, the line of stroke of the followers passes through the axis of the cam shaft. 20
- Q.6 a) Explain the function generation of synthesis problem. 5  
 b) Design a four-link mechanism to coordinate three positions of the input and output links for the following angular displacement:  
 $\theta_{12} = 60^\circ$        $\theta_{12} = 30^\circ$   
 $\theta_{13} = 90^\circ$        $\theta_{13} = 50^\circ$  . 15
- Q.7 a) Briefly explain the Kennedy theorem. 5  
 b) The mechanism as shown in the figure has the following dimensions:  
 $OA = 200$  mm;  $AB = 1.5$  m,  $BC = 600$  mm,  $CD = 500$  mm and  $BE = 400$  mm  
 locate all the instantaneous centres.  
 If the crank  $OA$  rotates uniformly at 120 r.p.m clockwise.  
 Find: i) The velocity of B, C and D.  
 ii) The angular velocity of the link AB, BC and CD.



15

**End Semester Examination, Dec. 2016**  
**B. Tech.— Fifth Semester**  
**INDUSTRIAL ENGINEERING (M-501A)**

Time: 3 hrs.

Max Marks: **100**

No. of pages: **1**

Note: Attempt **FIVE** questions in all; **Q.1** is **compulsory**. Attempt **ANYTWO** questions from **PART-A** and **TWO** questions from **PART-B**. Each question carries equal marks.

- Q.1 a) Differentiate between 'partial' and 'total productivity measures'.  
b) Distinguish between 'fixed' and 'variable costs'.  
c) Explain the importance of "work study".  
d) What do you understand by 'inventory control'?  
e) Explain "total quality management". **4×5**

**PART-A**

- Q.2 a) Give the process of method study and work measurement in detail. **12**  
b) Explain the process of work sampling and PMTS in detail. **8**
- Q.3 a) What do you understand by the term "cost"? How do you classify different types of cost? **10**  
b) Explain BEQ graphically and algebraically. **10**
- Q.4 a) Calculate economic batch quantity (EBQ) graphically and algebraically. **10**  
b) ABC corporation has got a demand of part A at the rate of 10,000 units per year. The cost per unit is ₹2, it costs ₹36 to place an order. Inventory carrying cost is 9%.  
Determine:  
a) Economic order quantity (EOQ).  
b) Optimum number of orders. **5×2**

**PART-B**

- Q.5 a) What do you understand by the term 'production system'? Explain various types of production systems used in industry. **10**  
b) Given below are jobs and the processing time in hrs. on machine M1 and M2:

Job	1	2	3	4	5
M1	5	1	9	3	10
M2	2	6	7	8	4

Calculate:

- i) The elapsed time after determining the optimum sequence of operation.  
ii) The ideal time on machines. **5×2**
- Q.6 a) What are control chart? Explain different types of control charts and how they are used to control the quality of product. **10**  
b) Determine the control limits for  $\bar{X}$  and  $R$  charts if  $\sum \bar{X} = 357.50$  and  $\sum R = 9.90$ . Number of subgroups = 20. It is given that  $A_2 = 0.18$ ,  $D_3 = 0.41$ ,  $D_4 = 1.59$  and  $d_2 = 3.735$ . **10**
- Q.7 Write short notes on (**ANY FOUR**):  
a) Just in time (JIT).  
b) ISO 9000 quality system.  
c) Kaizen.  
d) Deming awards.  
e) TQM. **5×4**

# End Semester Examination, Dec. 2016

B. Tech.— Fifth Semester

## DYNAMICS OF MACHINES (M-502A)

Time: 3 hrs.

Max Marks: 100

No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

Q.1 Briefly explain the following:

- a) Static balancing.
- b) Primary and secondary forces in reciprocating masses.
- c) Variation of tractive force.
- d) Height of governor.
- e) Hunting in governor.
- f) Gyroscopic effect on a rolling plane.
- g) Gyroscopic couple.
- h) Equilibrium conditions of a two force member.
- i) Static equilibrium.
- j) Piston effort in engine.

2×10

### PART-A

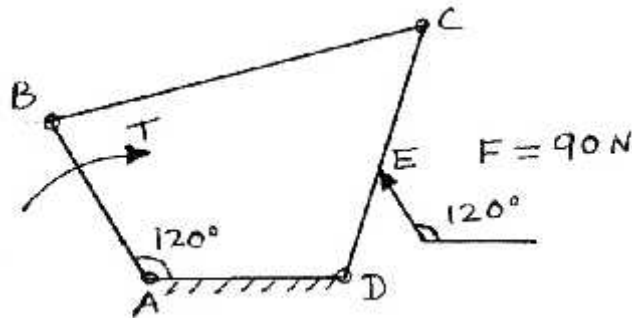
- Q.2 a) Describe the conditions for complete balance of several rotating masses in different planes. 5
- b) Four masses A, B, C, and D revolve in the same plane. The masses are 12 kg, 10 kg, 20 kg and 16 kg respectively and their radii of rotation are 40 mm, 60 mm, 70 mm and 30 mm. The angular positions of the masses B, C and D are 60°, 135° and 270° from the mass A. Find the magnitude and position of the balancing mass at a radius of 100 mm. 15
- Q.3 a) Derive an expression for the maximum variation in tractive force in a two cylinder locomotive with cranks set at 90° to each other. 10
- b) Find out the expressions for primary and secondary forces and couples in an IN-line four cylinder engine in terms of crank angle  $\theta$ . Make usual assumptions. 10
- Q.4 A four wheeled trolley car of mass 2000 kg runs on rails which are 1.5 meters apart. It travels around a curve of 30 m radius at 26 km/hr. Wheel diameter is 750 mm. Each of the two axles are driven by a motor which runs in opposite direction of the wheels and at a speed 5 times the speed of the wheels moment of inertia of each axle with gear and wheels is 20 kg-m<sup>2</sup>. Each motor has moment of inertia of 15 kg-m<sup>2</sup>. Center of gravity of the car is 0.8 m above the rail level. Find vertical force exerted by each wheel on the rails. 20

### PART-B

- Q.5 a) Briefly explain the following terms in governors:
- i) Equilibrium speed.
  - ii) Maximum and minimum equilibrium speed.
  - iii) Sleeve lift. 2×3
- b) All the arms of a porter governor are 178 mm long and are hinged at a distance of 38 mm from the axis of rotation. The mass of each ball is 1.15 kg and mass of the sleeve is 20 kg. The governor sleeve begins to rise at 280 rpm, when the links are at an angle of 30° to the vertical. Assuming friction force to be constant, determine the

minimum and maximum speed of rotation when the inclination of the arms to the vertical is  $45^\circ$ . 14

- Q.6 a) Briefly explain the following:
- Equilibrium conditions for a member with two forces and a torque.
  - Equilibrium conditions for a four force member.  $2 \times 2$
- b) A four bar mechanism (Figure 1) is acted upon by a force 90 N at an angle of  $120^\circ$  as shown in figure. Dimensions of the links are as under:  
 $AD = 500 \text{ mm}$ ,  $AB = 500 \text{ mm}$ ,  $BC = 1000 \text{ mm}$ ,  $DC = 700 \text{ mm}$ ,  $DE = 300 \text{ mm}$ .  
 Determine the input torque T on the link AB for static equilibrium of the mechanism.



16

- Q.7 a) Explain the concept of Equivalent offset inertia force in dynamic force analysis. 5
- b) In a vertical steam engine, the connecting rod is 4.5 times the crank. Mass of the reciprocating part is 120 kg and the stroke of the piston is 440 mm. The engine runs at 250 rpm. Net load on the piston due to steam pressure is 25 kN when the crank has turned  $120^\circ$  from TDC. Determine:
- Thrust in the connecting rod.
  - Pressure on side bars.
  - Tangential force on the crank pin.
  - Trust in the bearings.
  - Turning moment on the crankshaft.  $3 \times 5$

End Semester Examination, Dec. 2016  
B. Tech.–Fifth Semester  
MACHINE DESIGN(M-503)

Time: 3 hrs

Max Marks: 100

No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

- Q.1
- What are the causes of stress concentration?
  - What is Goodman line?
  - What types of stresses are induced in shafts?
  - Which theories of failure are applicable for shafts?
  - What are the functions of springs?
  - Distinguish between closely coiled and open coiled helical spring.
  - What is hydrodynamic lubrication?
  - What are functions of bearings?
  - What is a parallel helical gear?
  - What are design considerations in forgings?
- 2x10

PART-A

- Q.2
- A rotating bar made of 45C8 ( $S_{ut}=630 \text{ N/mm}^2$ ) is subjected to a completely reversed bending stress. The corrected endurance limit of the bar is  $315 \text{ N/mm}^2$ . Calculate the fatigue strength of the bar for a life of 90,000 cycles. 14
  - What is difference between Gerber curve and Soderberg and Goodman lines? 6
- Q.3
- What are disadvantages of hollow shaft over solid shaft? 6
  - A solid circular shaft of diameter  $d$  is subjected to a bending moment of  $M_b$  and torsional moment of  $M_t$ . Prove that according to maximum principal stress theory:  
$$\frac{S_{yt}}{(f_s)} = \frac{16}{fd^3} \left[ M_b + \sqrt{M_b^2 + M_t^2} \right]$$
14
- Q.4
- What are the applications of multi-leaf springs? 5
  - It is required to design a helical compression spring subjected to a force  $500 \text{ N}$ . Deflection of spring corresponding to this force is  $20 \text{ mm}$ . The spring index is 6. The spring is made of cold drawn steel wire with ultimate tensile strength of  $1000 \text{ N/mm}^2$ . The permissible shear stress for spring wire can be taken as 50% of ultimate tensile strength ( $G = 81370 \text{ N/mm}^2$ ). Design the spring and calculate:  
i) Wire diameter.      ii) Mean coil diameter.      iii) Number of active coils.  
iv) Total number of coils.      v) Free length of spring.      vi) Pitch of the coils. Assume of gap of  $1 \text{ mm}$  between adjacent coils under maximum load conditions. The spring has square and ground ends. 15

PART-B

- Q.5
- Name the various types of ball bearings. What is  $L_{10}$  life? 8
  - A ball bearing with a dynamic load capacity of  $22.8 \text{ kN}$  is subjected to a radial load of  $10 \text{ kN}$ . Calculate:  
i) Expected life in million revolutions that 90 % of bearings will reach.  
ii) The corresponding life in hours, if the shaft is rotating at  $1450 \text{ rpm}$ . 12

- Q.6 a) What is law of gearing? With a neat sketch of a spur gear, show its various parts and define terminology. 10
- b) A pair of spur gears consists of a 20 teeth pinion meshing with a 120 teeth gear. The module is  $4\text{ mm}$ . Calculate:
- i) Centre distance.
  - ii) Pitch circle diameters of pinion and gear.
  - iii) Addendum and dedendum
  - iv) Tooth thickness. 10
- Q.7 a) Define ergonomics. Explain ergonomics and value engineering in design. 10
- b) What is standardization? Explain various design considerations in casting. 10

End Semester Examination, Dec. 2016  
B. Tech.— Fifth Semester  
PRODUCTION ENGINEERING (M-504B)

Time: 3 hrs.

Max Marks: 100

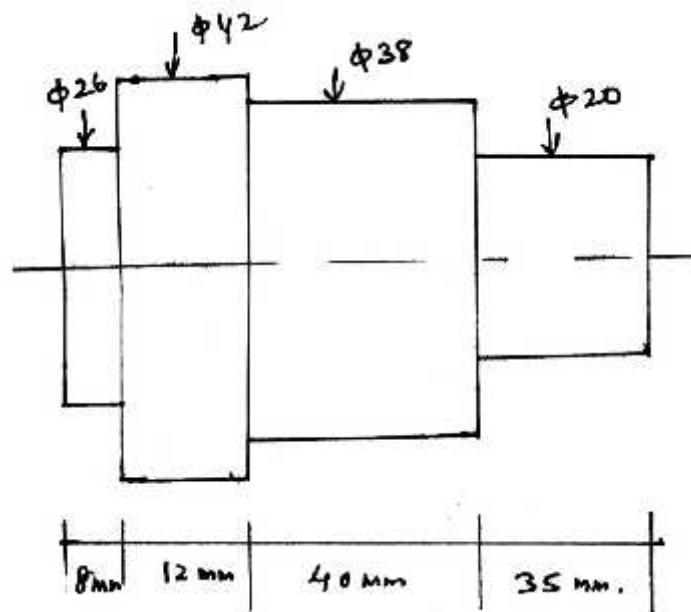
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Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

- Q.1
- Define 'process planning'.
  - Explain the 'tolerance stacking'.
  - Draw a neat and labeled diagram of a locating device.
  - State the purpose of clamping devices.
  - Differentiate between simple, compound and combination dies.
  - State the significance of 'clearance' in punches and dies.
  - State advantages of thread forming over thread cutting.
  - Draw a neat and labeled diagram of a 'Solid tap'.
  - What are the causes of wheel unbalancing in abrasive grinding terminology.
  - Explain the term: 'Truing and Dressing' used in grinding terminology.
- 2 × 10

PART-A

- Q.2 A batch of 500 components of steel is to be produced from a blank  $\varnothing 43 \times 97 \text{ mm}$ . All dimensions are in mm.  
Generate a process sheet for the components as shown in the figure:



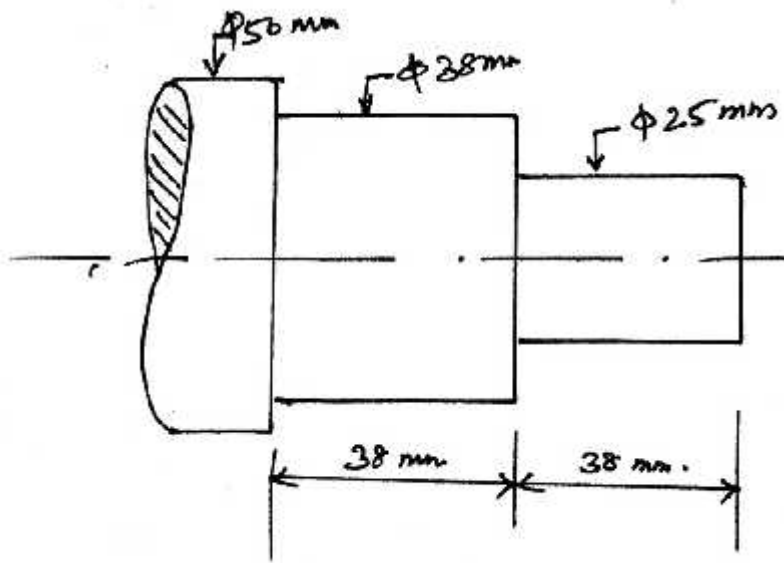
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- Q.3
- Explain various locating devices used in jigs and fixtures with the help of a neat and labeled diagrams. 10
  - Draw a neat and labelled diagram of a jig and fixture. 10
- Q.4
- Find the total force and dimensions of a die and punch to produce a washer of 5 cm outside diameter with a 2.4 cm diameter hole from a material 4 mm thick and having shear strength of  $360 \text{ N/mm}^2$ . 12
  - Draw a neat and labeled diagram of a compound die. 8

PART-B



- Q.5 a) Explain "Wheel structure" and "Wheel grade" used in grinding terminology. 5  
 b) Explain each term in detail for the following specification of a grinding wheel- 51A36L5V23. 8  
 c) State the principle and working of a cylindrical grinding process with the help of neat diagram. 7
- Q.6 Write notes on the following:  
 a) Gear manufacturing methods.  
 b) Thread manufacturing methods. 10×2
- Q.7 a) Estimate the time to drill a  $\phi 12.7\text{ mm}$  hole in a brass plate of 50 mm thickness. The cutting speed is 75 m/min and feed is 0.175 mm/rev. 10  
 b) What is the machining time to turn the dimensions given in figure? The material is brass with a cutting speed of 100 m/min and a feed of 0.75 mm/revolution.



End Semester Examination, Dec. 2016  
B.Tech-Fifth Semester  
METROLOGY MEASUREMENT AND CONTROL (M-505)

Time: 3 hrs

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

- Q.1
- a) Define the term: 'metrology'.
  - b) What are the bases used for selection of measuring instrument?
  - c) Name temperature measuring devices.
  - d) How torque of a shaft is measured?
  - e) Define 'inductance' and 'capacitance'.
  - f) What is function of photo Cells?
  - g) Write the static characteristics of instrument.
  - h) What is transfer function used in control system?
  - i) What is amplifier?
  - j) Name the elements of a control system.
- 2x10

PART-A

- Q.2
- a) What are the methods and tools used for linear measurement? 10
  - b) State the importance of geometric tolerance of manufacturing components. Describe the roughness checking method. 10
- Q.3
- a) Explain principle, construction and working of thermocouple temperature measurement in detail. 10
  - b) Discuss the working of torque testing dynamometers in detail. 10
- Q.4
- a) Explain the term 'transducer as a device' with the help of any one example 10
  - b) Discuss the types of velocity measurement. 10

PART-B

- Q.5
- a) Explain open and closed loop system. 8
  - b) Describe the block diagram and overall transfer function of a multi loop control system. 12
- Q.6
- a) What do you mean by zero, first and second order system of response. Derive expression for first order system. 12
  - b) What are various types of errors in a measuring instrument? What precautions are required during measurement? 8
- Q.7
- a) Write short notes on (any four):
    - i) Bridge circuit.
    - ii) Noise problems.
    - iii) DAC converter.
    - iv) Voltage recording devices.
    - v) Interfacing.
- 4x5

End Semester Examination, Dec. 2016  
B.Tech-Fifth Semester  
MACHINE DESIGN-I (M-508)

Time: 3 hrs

Max Marks: 100

No. of pages: 2

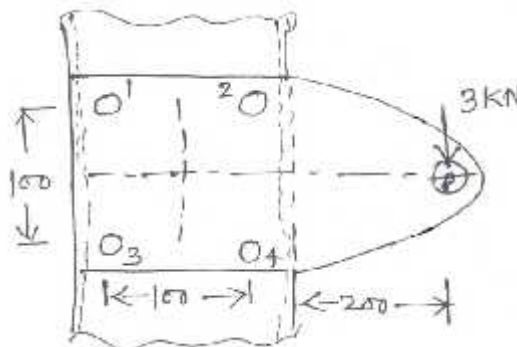
Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

- Q.1
- What is factor of safety in engineering design?
  - How will you select a material for engineering design?
  - What is threaded joint?
  - State disadvantages of threaded joint?
  - What is caulking process?
  - State advantages of welded joint over riveted joint.
  - What are advantages of V-belts over flat-belts?
  - What is function of coupling?
  - Name different types of clutches.
  - Classify different types of brakes.

2x10

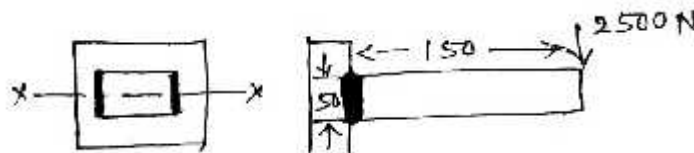
PART-A

- Q.2
- What is design philosophy? Describe the problem identification in design philosophy. 10
  - What do you mean by brain storming in engineering design? Explain preliminary design concept in brief. 10
- Q.3
- A steel plate subjected to a force of 3kN and fixed to a vertical channel by means of four identical bolts is shown in the figure. The bolts are made of plain carbon steel  $45C_8$  ( $S_{yt} = 380 \text{ N/mm}^2$ ) and factor of safety is 2. Determine the diameter of the shank. All dimensions are in mm.



14

- Why are V-threads used in a power screw? Write the type of threads used for power screw. 6
- Q.4
- A welded joint as shown in the figure is subjected to an eccentric load of 2500N. Find the size of the weld, if the maximum shear stress in the weld is not to exceed  $50 \text{ N/mm}^2$ .



14

- What do you understand by efficiency of riveted joint? What is fulling? What is its objective? 6

## PART-A

- Q.5 a) A V-belt drive is required for a 15 kW, 1440r.p.m electric motor, which drives a centrifugal pump running at 360 r.p.m for a service of 24 hrs/day. From space considerations, the centre distance should be approximately 1m. Determine:
- i) Belt specifications.
  - ii) Number of belts.
  - iii) Correct centre distance.
  - iv) Pulley dimensions. 15
- b) What is coupling? What is difference between coupling and clutch? 5
- Q.6 a) What are two theories applied to friction plates? Discuss. 8
- b) An automobile single plate clutch consists of two pairs of contacting surfaces. The outer diameter of the friction disc is 270mm. The coefficient of friction is 0.3 and maximum intensity of pressure is  $0.3\text{N/mm}^2$ . Clutch is transmitting a torque of 531 Nm. Assuming uniform wear theory, calculate:
- i) The inner diameter of the friction disc.
  - ii) Spring force required to keep the clutch engaged. 12
- Q.7 a) An automobile vehicle weighing 13.5 kN is moving on a level road at a speed of 95 KM/hr. When the brakes are applied, it is subjected to a uniform deceleration of  $6\text{m/sec}^2$ . There are brakes on all four wheels. The tyre diameter is 750mm. The kinetic energy of the rotating part is 10% of the kinetic energy of the moving vehicle. The mass of each brake drum assembly is 10 Kg and specific heat capacity is  $460\text{J/kg}^\circ\text{C}$ . Calculate:
- i) The braking time.
  - ii) Braking distance.
  - iii) Total energy absorbed by each brake.
  - iv) Torque capacity of each brake.
  - v) Temperature rise in brake drum assembly. 15
- b) What are the conditions of self-locking in differential band brake? 5

End Semester Examination, Dec. 2016  
B. Tech.– SixthSemester  
OPERATION RESEARCH (M-601A)

Time: 3 hrs.

Max Marks:100

No. of pages:2

Note: Attempt FIVE questions in all;Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

- Q.1 a) What are different methods useful for decision making under uncertainty.  
b) What do you mean by infeasibility and unsoundness in linear programming?  
c) What is degeneracy in transportation problem?  
d) Explain the terms:'balking, reneging and jockeying'.  
e) What are the differences between CPM and PERT techniques? 4 × 5

PART-A

- Q.2 a) What is operation research? What are the characteristic and limitations of operation research techniques? 8  
b) A TV dealer finds that cost of TV in stock for a week is ` 30/- and cost of unit shortage is ` 70/-. The probability of weekly sales is as follows:

Sales :	0	1	2	3	4	5	6
Probability	0.10	0.10	0.20	0.25	0.15	0.15	0.05

How many units the dealer should order? Also find the EVPJ. 12

- Q.3 a) Obtain the dual of following:  
Maximize:  $Z = 8x_1 + 10x_2 + 11x_3$   
Subject to  
 $2x_1 - 3x_2 + 2x_3 \geq 7$   
 $4x_1 + 3x_3 \leq 2$   
 $x_1, x_2, x_3 \geq 0$  6

- b) Maximize:  $Z = 4x_1 + 6x_2 + 8x_3$   
Subject to  
 $3x_1 + x_2 + 4x_3 \leq 300$   
 $2x_1 + 4x_2 + 2x_3 \geq 240$   
 $2x_1 + 3x_2 + 3x_3 = 270$   
 $x_1, x_2, x_3 \geq 0$  14

- Q.4 a) What are the necessary and sufficient conditions for a solution to be called as initial basic feasible solution in transportation problem? 8

- b) Optimize the following assignment problem:

	A	B	C	D	E
1	11	17	8	16	20
2	9	7	12	6	15
3	13	16	15	12	16
4	21	24	17	28	26
5	14	10	12	11	13

## PART-B

- Q.5 A self-service store employs one cashier at its counter. Nine customers arrive on an average every five minutes while cashier can serve 10 customers in five minutes. Assuming Poisson distribution for arrival rate and exponential distribution for service time, find:
- a) Average no of customers on the system.
  - b) Average queue length.
  - c) Probability that more than two customers are at the counter.
  - d) Probability that no customer is waiting to be served.
- 20
- Q.6 a) Define event, activity, looping, dangling, path and dummy on a network diagram. 6
- b) A project schedule has following characteristics:
- | Activity | Time | Activity | Time |
|----------|------|----------|------|
| 1-2      | 4    | 5-6      | 4    |
| 1-3      | 1    | 5-7      | 8    |
| 2-4      | 1    | 6-8      | 1    |
| 3-4      | 1    | 7-8      | 2    |
| 3-5      | 6    | 8-10     | 5    |
| 4-9      | 5    | 9-10     | 7    |
- i) Construct the network.
  - ii) Find critical path.
  - iii) Find total float, free float and independent float.
- 14
- Q.7 a) What is simulation? Describe its advantages and main limitations in detail. 10
- b) Explain Monte-Carlo method of simulation. Give the advantages and disadvantages of this method in detail. 10

End Semester Examination, Dec. 2016  
B. Tech.—Fifth/ Sixth Semester  
CAD / CAM (M-602)

Time: 3 hrs.

Max Marks: 100

No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt ANYTWO questions from PART-A and TWO questions from PART-B. Each question carries equal marks.

Q.1 Briefly answer:

- a) What is transformation?
- b) What is isometric projection?
- c) Define 'scaling matrix' and 'reflection matrix' about y-axis.
- d) What is CSG?
- e) What is the function of G-word in part programming?
- f) Explain G54 code.
- g) Define 'synthetic curves'.
- h) Explain  $C^1$  continuity in curves.
- i) What is characteristic polygon?
- j) Define 'ruled surface'.

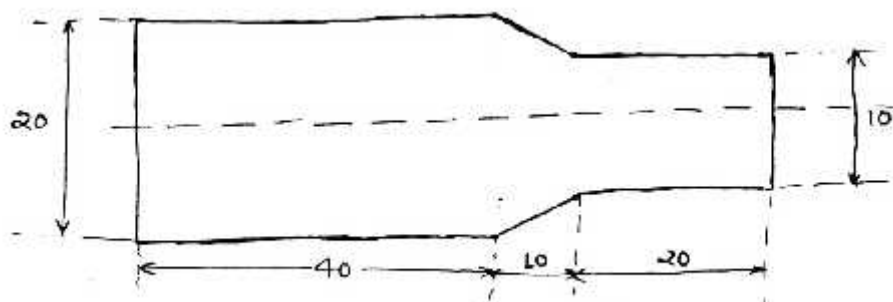
2 × 10

PART-A

- Q.2 a) Define 'CAD/CAM and CIM'. Give a brief descriptions of their applications in industries. 10
- b) Explain following with examples:
- |         |            |                    |    |
|---------|------------|--------------------|----|
| i) CSG. | ii) B-rep. | iii) Sweep solids. | 10 |
|---------|------------|--------------------|----|
- Q.3 a) Explain characteristics of Bezier curve with help of its parametric equation. 10
- b) Generate a Bezier curve using following control points: (1, 2), (3, 4), (6, -6) and (10, 8). Compute at least six points on curve. 10
- Q.4 a) A line having end points (2, 2) and (12, 9) is reflected about a line with equation  $y = 2x + 5$ . Find the final position of line. 10
- b) A line having end points (25, 8, 90) and (6, 12, 80) is rotated about y-axis, keeping point (25, 8, 90) fixed, by an angle of  $30^\circ$  clockwise. Find new coordinates of line. 10

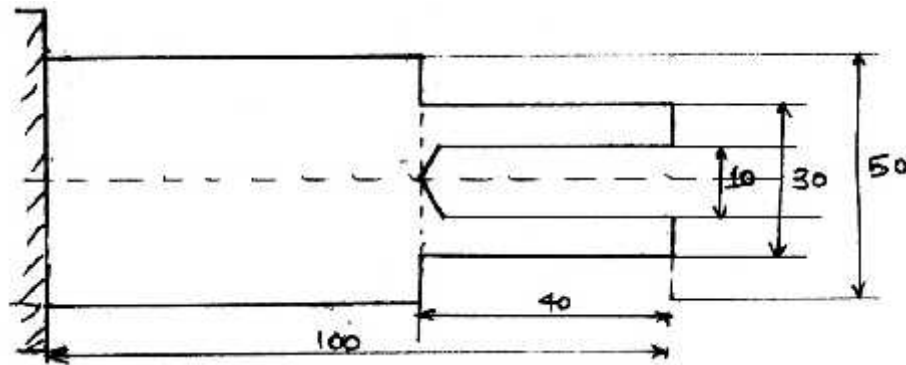
PART-B

- Q.5 a) What is automation? Discuss various types of automations used in industries with examples. 10
- b) Write an NC part program for following part:



All dimensions are in mm.

- Q.6 a) Differentiate between fixed and canned cycles with appropriate examples. Discuss how canned cycle can reduce programming effort. 10
- b) Write an NC part program for given part: 10



All dimensions are in mm.

- Q.7 a) What is group technology? Explain part classification and write various coding systems. Why group technology is developed? Write its advantages. 10
- b) Explain manufacturing cell. Classify and explain the benefits of cellular manufacturing. 10



End Semester Examination, Dec. 2016  
B. Tech.– Fourth / Sixth Semester  
HEAT TRANSFER (M-604)

Time: 3 hrs.

Max Marks: 100

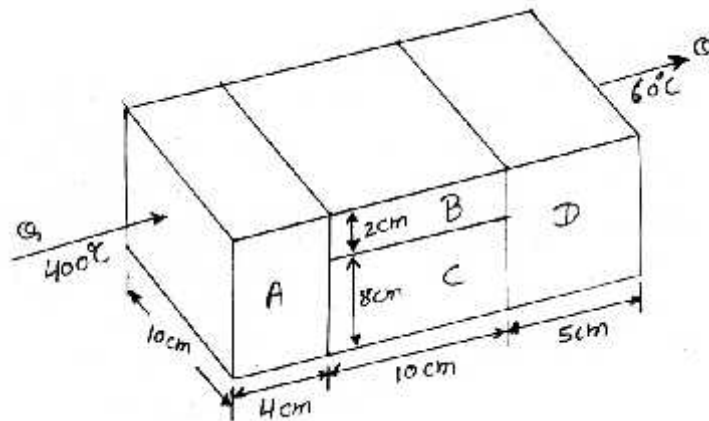
No. of pages: 3

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

- Q.1
- State the Fourier rate equation for heat transfer by conduction.
  - Define thermal diffusivity.
  - Define the efficiency and effectiveness of a fin.
  - How does a fin enhance heat transfer from a surface?
  - What is lumped system analysis?
  - Define Biot and Fourier numbers.
  - What is a thermal boundary layer?
  - Define shape factor.
  - State Stefan-Boltzmann Law.
  - What is a heat exchanger? Give some examples of heat exchangers.
- 2 × 10

PART-A

- Q.2
- Derive an expression for temperature distribution under one dimensional, steady-state heat conduction through a plane wall. 10
  - Find the heat flow rate through the composite wall as shown in figure. Assume one dimensional flow and the following values of thermal conductivity of wall materials.  $k_A = 150 \text{ W/m}^\circ\text{C}$ ,  $k_B = 30 \text{ W/m}^\circ\text{C}$ ,  $k_C = 65 \text{ W/m}^\circ\text{C}$  and  $k_D = 50 \text{ W/m}^\circ\text{C}$ .



10

- Q.3
- Derive an expression for temperature distribution and heat dissipation in a straight fin of rectangular profile for fin insulated at the tip. 10
  - A carbon steel rod ( $k = 54 \text{ W/m}^\circ\text{C}$ ) with a cross-section of an equilateral triangle (each side 5 mm) is 80 mm long. It is attached to a plane wall which is maintained at a temperature of  $400^\circ\text{C}$ . The surrounding temperature is at  $50^\circ\text{C}$  and unit surface conductance is  $90 \text{ W/m}^2^\circ\text{C}$ . Compute the heat dissipated by the rod. 10
- Q.4
- What are Heisler charts? Explain the significance of Heisler charts in solving transient conduction problems. 5
  - State the assumptions for lumped capacity analysis. 5
  - A large steel plate 50mm thick is initially at a uniform temperature of  $425^\circ\text{C}$ . It is suddenly exposed on both sides to an environment with convective coefficient 285

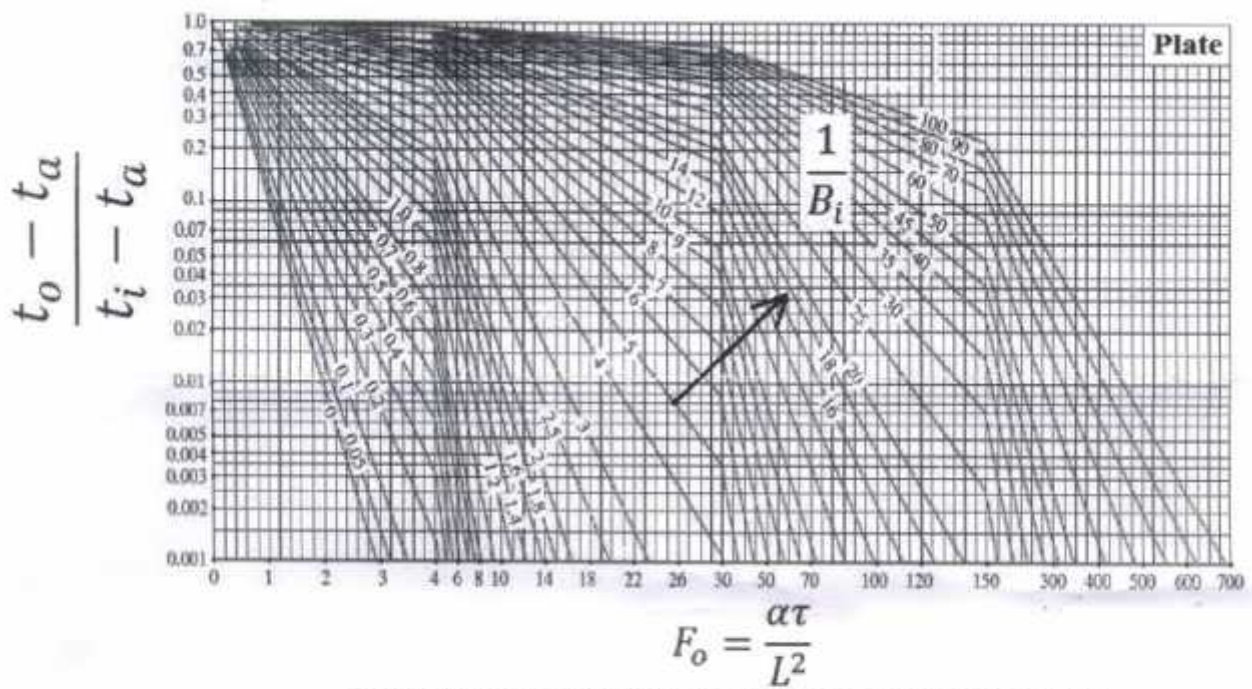
W/m<sup>2</sup>K and temperature 65°C. Determine the centre line temperature and the temperature inside the plate 12.5 mm from the mid plane after 3 minutes. Consider the following values for steel:

Thermal conductivity  $k = 42.5 \text{ W/mK}$ .

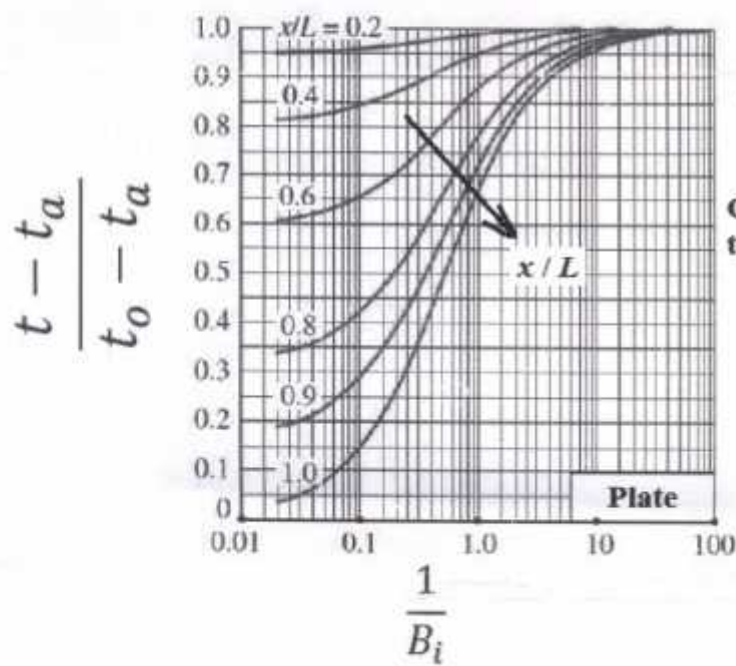
Thermal diffusivity  $\alpha = 0.043 \text{ m}^2/\text{hr}$ . 10

### PART-B

- Q.5 a) Derive the two dimensional energy equations for thermal boundary layer on a flat plate. State the relevant boundary conditions. 10
- b) A horizontal heated plate at 200°C and facing upwards has been placed in still air at 20°C. If the plate measures 1.25m × 1m, make calculations for the heat loss by natural convection.  
The convective film coefficient for free convection is given by the following empirical relation  
$$h = 0.32 (\theta)^{0.25} \text{ W/m}^2\text{K}$$
where  $\theta$  is the mean film temperature in degrees Kelvin. 10
- Q.6 a) Derive an expression for radiant heat exchange between two black surfaces. Use the concept of radiation shape factor to simplify the expression. 10
- b) A black body of total area 0.045m<sup>2</sup> is completely enclosed in a space bounded by 5 cm thick wall. The walls have a surface area 0.5m<sup>2</sup> and thermal conductivity of 1.07 w/m deg. If the inner surface of the enveloping wall is to be maintained at 215°C and the outer wall surface is at 30°C, calculate the temperature of the black body. Neglect the difference between inner and outer surface area of enveloping material. 10
- Q.7 a) Classify heat exchangers in detail. 5
- b) What is fouling in heat exchangers? How does it affect the performance of a heat exchanger? 5
- c) The flow rates of hot and cold water streams running through a parallel flow heat exchanger are 0.2 kg/s and 0.5 kg/s, respectively. The inlet temperatures on the hot and cold sides are 75°C and 20°C, respectively. The exit temperature of hot water is 45°C. If the individual heat transfer coefficients on both sides are 650 w/m<sup>2</sup>°C and overall heat transfer coefficient is 325 w/m<sup>2</sup>°C, calculate the area of the heat exchanger. 10



Heisler Chart for temperature History at the centre of a Plate



Correction Factor Chart for temperature history in a Plate

End Semester Examination, Dec. 2016  
B. Tech.– Sixth Semester  
MACHINE DESIGN-II (M-607)

Time: 3 hrs.

Max Marks: 100

No. of pages: 2

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part-A and TWO questions from Part-B. Each question carries equal marks.

- Q.1
- a) What is difference between failure due to static load and fatigue load?
  - b) Name different fatigue stress concentration factor.
  - c) What are functions of key?
  - d) What do you understand by lateral rigidity in shaft-design?
  - e) What is surging phenomenon in spring design?
  - f) How will you select suitable lubricant for bearing?
  - g) Write the properties required from lubricant to be used in bearing application.
  - h) Where do you use worm gear drive?
  - i) What are advantages of helical gears over spur gear?
  - j) What do you mean by ergonomic consideration in engineering design?
- 2 × 10

PART-A

- Q.2
- a) Explain with neat sketches, the difference among Gerber curve and Soderberg and Goodman lines. 10
  - b) A forged steel bar, 50 mm in diameter, is subjected to a reversed bending stress of  $250 \text{ N/mm}^2$ . The bar is made of steel 40C<sub>8</sub> ( $S_{ut} = 600 \text{ N/mm}^2$ ). Calculate the life of bar for a reliability of 90%.  
Assume,  $k_a = 0.44$ ,  $k_b = 0.85$ ,  $k_e = 0.897$  10
- Q.3
- a) What types of stresses are induced in shaft? Discuss. 6
  - b) A rotating shaft, 40 mm in diameter, is made of steel FeE 580 ( $S_{yt} = 580 \text{ N/mm}^2$ ). It is subjected to a steady torsional moment of 250 N-m and bending moment of 1250 N-m. Calculate the factor of safety based on:
    - i) Max<sup>m</sup> principal stress theory.
    - ii) Max<sup>m</sup> shear stress theory. 14
- Q.4
- a) What are the applications of multi-leaf spring? Explain the objective of nipping of leaf spring. 6
  - b) A direct reading spring balance consists of helical tension spring, which is attached to a rigid support at one end and carries weights at the other free end. The length of the scale is 75 mm. Maximum capacity to measure weight is 500 N. Spring is made of oil-hardened and tempered steel wire with ultimate tensile strength of  $1400 \text{ N/mm}^2$ . Design the spring and calculate:
    - i) Wire diameter.
    - ii) No. of active coils.
    - iii) Mean coil diameter.
    - iv) Required spring rate and actual spring rate if spring index = 6, and  $G = 81370 \text{ N/mm}^2$ . 14

PART-B

- Q.5 a) A ball bearing is subjected to a radial force of 2500 N and axial force of 1000 N. The dynamic load carrying capacity of bearing is 7350 N. The values of X and Y factors are 0.56 and 1.6 respectively. Shaft is rotating at 720 rpm. Calculate the life of bearing. 12
- b) Explain hydrostatic and hydrodynamic lubrication in bearing. 8
- Q.6 a) A steel pinion with 20° full depth involute teeth is transmitting 7.5 kW power at 1000 rpm from an electric motor. Starting torque of motor is twice the rated torque. The number of teeth on pinion is 25, while module is 4 mm. Face width is 45 mm. Assuming that velocity factor accounts for dynamic load. Calculate:
- i) Effective load on the gear tooth. 15
- ii) The bending stresses in the gear tooth. 15
- b) Briefly describe the terminology of helical gear. 5
- Q.7 a) Discuss the role of processing in engineering design. Explain the design considerations for machining. 12
- b) What is standardization? Describe the role of value engineering in design. 8

## End Semester Examination, Dec. 2016

B. Tech.– Sixth Semester

### IC ENGINES AND GAS TURBINES (M-621)

Time: 3 hrs.

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part A and TWO questions from Part B. Each question carries equal marks.

- Q.1
- What are pumping losses and blow by loss?
  - Define 'indicated efficiency' and 'mechanical efficiency'.
  - Classify different types of cooling systems.
  - What do you mean by function of lubrication?
  - What are the assumptions made in air-standard cycle analysis?
  - What do you mean by pre-ignition in S.I. engine?
  - What are the stages of combustion in C.I. engines?
  - Write the formula of optimum pressure ratio for maximum power output.
  - Define the 'effectiveness of regenerator'.
  - List various methods available for finding friction power of an engine.
- 2 × 10

#### PART-A

- Q.2 The volume ratio of compression and expansion for a diesel engine as measured from an indicator diagram are 15.3 and 7.5 respectively. The pressure and temperature at the beginning of compression are 1 bar and 27°C. Assuming an ideal engine, determine mean effective pressure the ratio of maximum pressure to mean effective pressure and efficiency. Also find the fuel consumption per kWh if indicated thermal efficiency is 0.5 of ideal efficiency, mechanical efficiency is 0.8 and calorific value of fuel is 42000 KJ/kg. 20
- Q.3
- What is the main function of a spark plug? Draw a neat sketch of a spark plug and explain its various parts. 10
  - A simple carburettor has to supply 5 kg of air/min. The atmospheric air is at a pressure of 1.013 bar and at the temperature of 27°C. Calculate throat diameter of venturi if the air flow velocity at the throat is 90 m/sec and velocity coefficient is 0.8. Assume isentropic flow and throat air as compressible flow. 10
- Q.4
- Compare knocking in C.I. engine with the phenomenon of detonation in S.I. engine. 10
  - Explain stages of combustion in S.I. engine. 10

#### PART-B

- Q.5
- Classify different types of lubricating systems and explain any one in detail. 10
  - How the lubricating oils are graded as per SAE rule? 10
- Q.6 A 4-cylinder, four stroke S.I engine has a compression ratio 8 and bore of 100 mm with a stroke = bore. The volumetric efficiency of each cylinder is 75%. The engine operates at a speed of 4800 rpm with an air/fuel ratio of 15. The calorific value of fuel is 42,000 kJ/kg. Density of air is 1.12 kg/m<sup>3</sup> and mean effective pressure in the cylinder is 10 bar and mechanical efficiency is 80%. Determine:
- Indicated thermal efficiency.
  - Brake power.
- 20

- Q.7 A closed cycle gas turbine develops a net output of 1500 kW air at 1 bar and 20°C enters the compressor and the pressure ratio is 6. The maximum temperature at the inlet to the turbine is 800°C. Find isentropic efficiency of turbine and mass flow rate of air if isentropic efficiency to compressor is 0.85 and plant efficiency is 20%. 20

End Semester Examination, Dec. 2016  
B. Tech.– Sixth Semester  
POWER PLANT ENGINEERING (M-622)

Time: 3 hrs.

Max Marks: 100

No. of pages: 1

Note: Attempt FIVE questions in all; Q.1 is compulsory. Attempt any TWO questions from Part-A and TWO questions from Part-B. Each question carries equal marks.

- Q.1
- a) What is incremental rate theory?
  - b) Discuss the role of moderator in a nuclear power plant.
  - c) What is PFBC system?
  - d) Give working of CANDU-type reactor.
  - e) Write the principle of electrostatic precipitator.
  - f) Explain using sketch "Hydrological cycle".
  - g) What is Rankine cycle?
  - h) Define 'reserve factor'.
  - i) How Hydraulic turbines can be classified?
  - j) Elaborate types of power plants.
- 2 × 10

PART-A

- Q.2
- a) The efficiency of a power plant depends on the site location. Discuss the factors on which site selection is being influenced. 10
  - b) Explain with a neat sketch "Hydro Electric Power Plant". What are various elements and components of it? 10
- Q.3
- a) Explain the ASH handling system in a steam power plant. 10
  - b) Differentiate between 'forced circulation' and 'natural circulation'. 10
- Q.4
- a) Write short notes on:
    - i) Ideal Regenerative Cycle.
    - ii) Stirling Cycle. 5 × 2
  - b) Explain working principle of a modern steam power plant and also draw a flow sheet. 10

PART-B

- Q.5
- A 200 MW power house is operating on combined cycle. Suction of air takes place at 2 bar and 300 K. The maximum temperature is 800°C. The pressure ratio is 8. The gas turbine exhaust is further heated to 800°C before entering into the boiler furnace. The steam production is at 50 bar and 600°C. The exhaust temperature is 200°C. The condenser pressure is 0.05 bar. Consider isentropic efficiencies of rotating machine to be 100%. Find out thermal efficiency of power plant. Take  $c_p = 1 \text{ kJ/kg K}$ , ratio of specific heats = 1.4, calorific value of fuel =  $4.2 \times 10^4 \text{ kJ/kg}$ . 20
- Q.6
- Explain the working principle of a nuclear power plant with a neat sketch. Also elaborate various nuclear reactions in detail. 20
- Q.7
- a) Explain the operating and performance characteristic of power plants. 10
  - b) A power plant has the following annual factors: load factor = 0.75, capacity factor = 0.60 and use factor = 0.65. Max. Demand = 60 MW. Estimate:
    - i) The annual energy production.



- ii) The reserve capacity over and above the peak load.
- iii) The hours during which the plant is not in service per year.